Exploring the relationship between childhood obesity and socioeconomic factors in South Africa: A secondary analysis of the National Income Dynamics Study data

by

YOLISWA NOKWAZI MZOBE

Submitted in partial fulfilment of the academic requirements for the degree of Masters in Population Studies in the school of Development Studies, University of KwaZulu-Natal Howard College campus, Durban

January 2017

Declaration

Submitted in partial fulfilment of the requirements for the degree of Master's in Population Studies, in the Graduate program in the school of Built Environment and Development Studies, University of KwaZulu-Natal, Durban, South Africa.

I declare that this dissertation is my own unaided work. All citations, references, borrowed ideas have been duly acknowledged. None of this work has been submitted previously for examination in any other University.

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Date

Abstract

The upsurge of childhood obesity brings forth potential chronic illness complications thus threatening the health of the young generation. Previously, studies showed that higher rates of childhood obesity were among groups of higher socioeconomic status.

Studies have shown that health status does not exist in a vacuum but rather is an integral part of socioeconomic factors. Socioeconomic status plays a crucial role in relation to health. However, there is an existing gap in literature - specifically in relation to childhood obesity. This study aimed to address this gap by looking at the relationship between childhood obesity (broken down into body mass index) and socioeconomic factors among children aged 5-12 years.

The findings of the study exhibit a significant relationship between childhood obesity and socioeconomic factors among 5-12 year old boys and girls in South Africa. Children residing in urban areas had the highest rates of obesity whilst children residing in rural areas had the lowest rates. This calls for the need for further exploration of the kind of lifestyle led by children in urban areas. This is indicative of the need for children's nutritional assessment among urban and rural areas in order to take steps towards combating obesity in young children. The highest rates were observed in the 5-year-old age group (boys and girls), and peaked for girls 10-years of age at 20%. On the contrary, underweight rates were highest for boy's 5-years of age and highest for girls at age 12. The highest rates of obesity were seen in the African population group, important to note that response rates in the survey were also highest in this population group and lowest among the White and Indian/Asian population groups.

Findings of this study point to the urgent requirement for policy makers to address the nutritional intake of children, especially in the 5-year-age category. There is also a need for researchers to think of ways of involving the White and Indian/Asian population group in surveys in order to gain more accuracy on the extent of existing issues, or lack thereof in these population groups.

Acknowledgements

I would like to express my sincere gratitude to my supervisor Mohammed Yacoob Vawda for believing in my potential and understanding my work style. This would not have been possible without your continued tailored support.

To my colleague, Vincent Maduna, thank you for believing in me and your endless support and guidance, which you offered so willingly.

To my family Dudu Ngcamu, Eunice Mzobe, Sibusiso Ndaba, Sonke Ngcamu, and Mondli Mdunge you have always been my unwavering pillars of support. Your presence kept me going. I wholeheartedly thank you for everything that you do.

To my late father Mduduzi Mnikathi, thank you for always educating me as a child about the importance of a balanced meal, I would not have chosen this topic if it were not for our conversations on the importance of nutrition.

Lastly, to my sweet Grandmother Eunice Khalelani Mzobe (who is convinced I am going to be a doctor) who makes the impossible possible. Thank you so much for truly supporting my aspirations. I dedicate this thesis to you.

Acronyms

NCDs - Non-communicable diseases

SEF - Socioeconomic factors

SES - Socioeconomic status

GNP - Gross National Products

HIV/AIDS - Human immunodeficiency virus / Acquired immune deficiency syndrome

NIDS - National Income Dynamics Study

BMI - Body Mass Index

CNS - Central nervous system

WHO - World Health Organisation

CDC - Centre for Disease Control

Contents

Chapter One

Introduction

1.1 Background

Young people's health, wellbeing and development is closely associated with social determinants. According to Currie et al. (2012) there is a great wealth of opportunity in relation to health, education, occupation, social engagement, discovery and fulfilment (Currie et al., 2012). It is therefore, about identifying and creating the conditions within which population health can thrive (Currie et al., 2012).

For us to create the aforementioned conditions – more specifically in the South African context, one would have to first analyse socioeconomic factors and their relationship to ill/good health. This is especially important as childhood obesity is often carried over into adulthood along with a vast array of non-communicable diseases (NCDs) (Sahoo et al., 2015) thus impacting on mortality and morbidity of our communities. It has also been found to negatively affect school performance in children. Understanding the cause of childhood obesity will allow for the tailoring of children's health policies in South Africa. "One strategy to prevent adult obesity is to focus more attention on the development of obesity in children" (Gable & Lutz, 2000, 293).

Body weight is regulated by multiple physiological mechanisms which maintain the balance between the intake and expenditure of energy (Ebbeling, Pawlak, Ludwig, 2002). These systems are precise, for example "a positive energy balance of about one serving sugar-sweetened soft drink per day would produce a 50Kg weight increase over ten years" (Ebbeling et al., 2002, 473). Thus, any factor which alters this precise balance between energy intake and expenditure by even a small fraction causes obesity in the long run. Genetic factors do play a role in individual predisposition however, the rising rates among genetically stable populations show that environmental and perinatal factors contribute to the childhood obesity epidemic

(Ebbeling et al., 2002). In this study, childhood obesity is explored in relation to socioeconomic factors which encompass environmental factors.

In this study, the term *childhood obesity* encompassed all levels of the Body Mass Index (BMI) namely; underweight, middle-weight, overweight, and obese. Each of these levels were explored in relation to socioeconomic factors.

It is important that we study the extent to which South African children are battling with childhood obesity, Mayosi et al. (2009) substantiate this point when they note, 'an insight into the extent of and risk factors for non-communicable diseases in South Africa is crucial for effective advocacy and action' (Mayosi et al., 2009, 1). The focus of this study is on children because early detection is better than late detection, and since the associated NCDs of childhood obesity (e.g. diabetes and hypertension) are often carried over into adulthood, it is better to catch it at an early age in order to harness it. This will aid in reducing the prevalence of obesity (morbidity) among future adult generations. The first step is to bring awareness to the prevalence of childhood obesity in South Africa.

When looking at existing papers on the prevalence of NCDs, one will find that the distribution varies across different socioeconomic groups (He, James, Merli, Zeng, 2014). For example, He et al. (2014) conducted a study that focused on the association of childhood obesity and overweight prevalence and income of the parents in China (He et al., 2014). This study found that 'overweight prevalence increased fastest among high income children between 1991 and 2004' (He et al., 2015). Similarly, this study will serve the same purpose; the results may vary, as there may be intervening contextual factors present in the South African context, which are not present in China such as the widespread burden of HIV/AIDS which receives most of the funding for preventative and curative measures. With this being said, the relationship between obesity and socioeconomic factors has been well established among adult populations in developing countries – a negative relationship between socioeconomic factors and obesity was found and positive relationship was found in developed countries (Bammann, Gwozdz, Lanfer, Barba, Henauw, Eiben, Fernandez-Alvira, Kovacs, Lissner, Moreno, Tornaritis, Veidebaum, and Pigeot, 2013).

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> 'For childhood obesity, the situation is less clear. In the landmark review of Sobal and Stunkard (2013) results for children in developed countries were found to be

> ambiguous, and negative as well as positive or no associations were found in the considered studies'
>
> (Bammann et al., 2013: 2)

Important to note however, countries were determined developed or undeveloped based on the situation of 1989, which may have bought bias towards these findings.

Medical professionals indicate that prevention is better than cure, in order for us to prevent obesity we need to familiarise ourselves with the root cause of it (Reilly, Armstrong, Dorosty, Emmett, Ness, Rogers, Steer, and Sherriff, 2005). Kruger et al. (2005) reiterate this point when they note, 'early identification of children at risk in relatively diverse geographic/cultural populations through suitable determinants is essential for prevention of childhood obesity' (Kruger et al., 2005, 252) the term socioeconomic factors was left out here. Studying socioeconomic factors in relation to childhood obesity will help point health personnel in the right direction with regards to developing strategies of decreasing the prevalence and in turn, decreasing morbidity which very often leads to mortality.

An extensive review of studies conducted before the year 1989 concluded that 'high SES [socioeconomic status] showed a consistent positive relationship to obesity in societies in developing countries' (Monteiro et al., 2004, 940). However, another study reviewed a number of studies done before 1989 to 2003 and different conclusions were drawn. Prior to 1989 it was believed that obesity would be a disease of those with higher SES, the results of this review were on the contrary, 'obesity in the developing world can no longer be considered solely a disease of groups of higher SES' (Monteiro et al., 2004, 943). It has become apparent that higher prevalence rates of obesity tend to be among the groups with lower socioeconomic status, as the Gross National Product (GNP) of the country increases (Monteiro et al., 2004). This shift of obesity from groups of high to low SES happens at earlier stages of economic development among women than men (Monteiro et al., 2004). For example, in South Africa it was found that the relationship between SES and women was positive in 1998 yet inverse for men (Monteiro et al., 2004, 942). Monteiro et al. (2004) note, 'more studies are necessary to clarify the exact relationship between socio-economic status and obesity, particularly among men' (Monteiro et al., 2004, 943).

A more recent study has revealed that there is an association between childhood obesity and urbanisation in South Africa. As Armstrong, Lambert, Sharwood & Lambert (2004) state, 'high

levels of obesity have been identified among urbanized South Africans' (Armstrong et al., 2004, 52). Again, it is the relationship between SES and *childhood* obesity that has not been looked at in depth. Wang (2001) conducted a cross-national study of obesity and examined the relationship between childhood obesity and SES however; their study population was outside of South Africa (Wang, 2001) and the results were inconsistent for children (Wang, 2001). Indeed, urbanization may have a significant influence on obesity however; from this association one cannot tell what kind of quality of life has an influence on childhood obesity. Urbanization does not necessitate an improved quality of life (Patel and Burke, 2009). Hence why looking at socioeconomic factors (SEF) would be advantageous in this regard. For instance, Cameron, Kgamphe, Leschner, & Farrant (1992) found that obesity is only linked with urbanization when SES is improved.

Childhood obesity can cause a child to develop a wide range of lifestyle diseases at a much earlier age. In support of this statement, Ebeling, Pawlak and Ludwig (2002) note, 'childhood obesity is a multisystem disease with potentially devastating consequences' (Ebeling et al., 2002, 473). Cole, Bellizi, Flegal and Dietz (2000) also suggest that childhood obesity is 'associated with several risk factors for later heart disease and other chronic diseases' (Cole et al., 200, 1240). Daniels (2006) notes, 'researchers are only gradually becoming aware of the gravity of the risk that overweight and obesity pose for children's health' (Daniels, 2006: 47). Daniels (2006) also speaks about the array of obesity related diseases which were once only common among adults such as; 'high blood pressure, early symptoms of hardening of the arteries, type2 diabetes, nonalcoholic fatty liver disease, polycystic ovary disorder and disordered breathing during sleep…the processes that lead to heart disease and stroke start in childhood' (Daniels, 2006, 47). Demographically, the repercussions of childhood obesity are major as they may reverse the life expectancy in South Africa (Daniels, 2006) even further. According to Bor, Herbst, Newell and Barnighausen (2013) 'In South Africa, life expectancy at age 15 declined from 67.4 years in 1990 to 58.7 years in 2009' (Bor et al., 2013, 961). Fortunately, life expectancy is now on the rise again thanks to antiretroviral therapy (ART) (Bor et al., 2013), in 2012 life expectancy was just above 60 years (Bor et al., 2013). If the prevalence of childhood obesity continues to increase the above trend will be reversed, 'such a possibility, makes obesity in children of utmost public health concern' (Daniels, 2006, 47).

South Africa has been identified as one of the countries experiencing increasing obesity (3.2% girls, 4.9% boys) and overweight (14.0% boys, 17.9% girls) rates among boys and girls aged 6 – 13 years (Armstrong et al., 2006, 439). This research aims to answer the question; what are

the demographic variables and socioeconomic factors contributing to childhood obesity among South African children? By doing so, this study will look at this rapidly growing pandemic from a social scientist perspective thus filling the gap in previously conducted research with regards to childhood obesity. For example, the study discussed above (conducted in South Africa) only studied children from ages 10 – 15 whereas this study looked at children from 5 – 12 years of age. Although the relationship between obesity and socioeconomic factors has been looked at in South Africa, the data is now outdated and the relationship between childhood obesity and socioeconomic factors has not been studied on the scale that this study aims to study it. Variables looked at in this study differed significantly from the above studies more importantly the North West study. This study looked at the following socioeconomic factors: marital status of the parents, income of the parents, place of residence, educational achievements of the parents and the child, and the race of the parent and the child.

1.2 Purpose and Significance of Study

Indeed, 'Health and health equity are important to the development of all countries' (Currie et al., 2012). From the above discussions, it is clear that childhood obesity can lead to premature death later on in life (Ebbeling et al., 2002) thus impacting on the development of a country (Currie et al., 2012). The sedentary lifestyle in which many of the world's population have adopted is conducive to rapid weight gain and potential diagnosis of obesity (Kruger, Kruger and MacIntyre, 2005). It is imperative we study the prevalence of this disease especially in children in order to prevent morbidity at an earlier stage in their lives as studies have shown that the complications of childhood obesity are indeed life threatening (Ebbeling, Pawlak & Ludwig, 2002). The complications of obesity are no different in children than they are in adults (Ebbeling et al., 2002), Ebbeling et al. (2002) note,

> 'Obesity in childhood causes hypertension, dyslipidaemia, chronic inflammation, increased blood clotting tendency, endothelial dysfunction, and hyperinsulinaemia. This clustering of cardiovascular disease risk factors, known as the insulin resistance syndrome, has been identified in children as young as 5 years of age
> (Ebbeling et al., 2002: 473).

Similar results were found in a study conducted in South Africa, Kruger, Puoane, Senekal & van der Merwe (2005) found that 'glucose and lipid toxicity associated with insulin resistance' (Kruger, Puoane, Senekal & van der Merwe, 2005, 491) form part of the pathogenesis of 'co-

morbid diseases of obesity' (Kruger et al. 2005, 491). To add to this devestating trend Must and Strauss (1999) found that, 'orthopedic, neurological, pulmonary, gastroenterological, and endocrine conditions...are becoming more common as the prevalence of severe overweight rises' (Must & Strauss, 1999, 2).

Monteiro, Moura, Conde, and Popkin (2004) reviewed studies that were published prior to 1989 on socio-economic status and obesity (Monteiro et al., 2004). However, it is worth noting that the above-mentioned reviewed studies were studies conducted in developing countries and their focus was on adults rather than children. There is a dearth of literature on childhood obesity and socioeconomic factors globally, and in South Africa. This study aimed to fill the existing gap in the literature of childhood obesity (5-12-year-old) in the South African context. This study also aimed to magnify the existing social inequalities in relation to body mass index (BMI) existing in South Africa.

1.3 Theoretical Framework

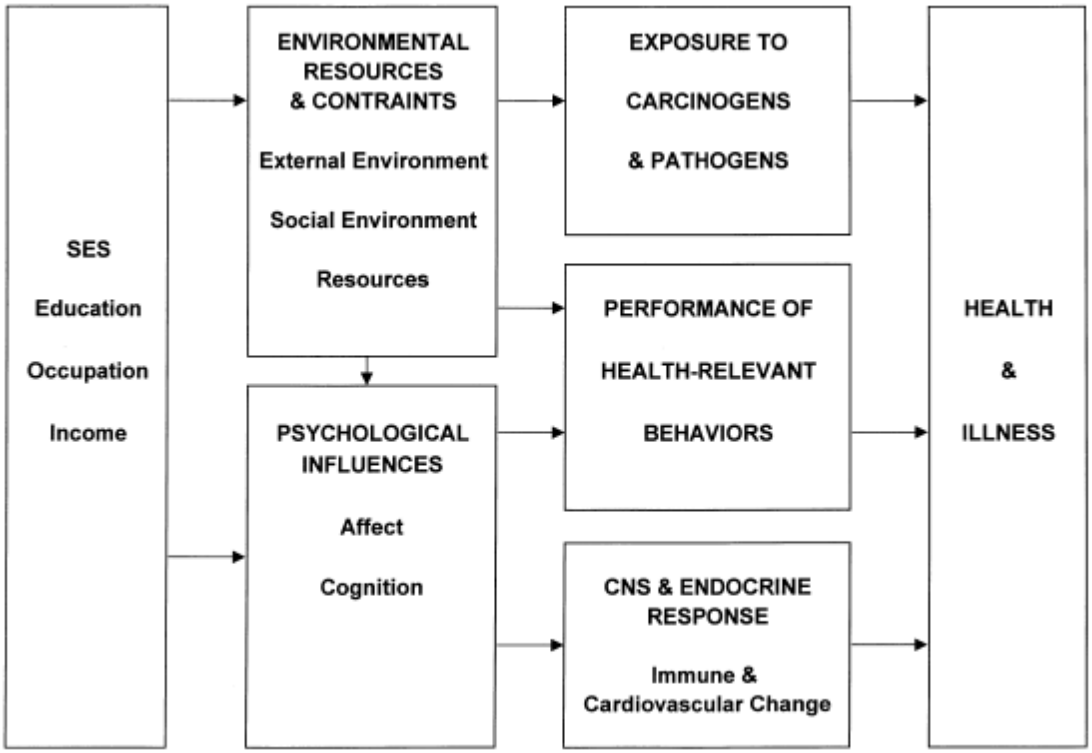
The model defines SEF with the following variables: income, years of schooling, and occupation. *Figure 1* below is an illustration of the theoretical framework chosen to guide the study. It was adopted from Adler and Ostroves' work conducted in 1999. It is a rather simple but useful illustration of how different levels of socio-economic status impact on health or lack thereof (Adler & Ostroves, 1999). Adler and Ostrove (1999) highlight the existence of a linear relationship between prevalence of chronic disease and SES (Adler & Ostrves, 1999). This is not the case for all diseases. However, many studies have shown strong, consistent SES gradient with diseases that carry heavy burden of morbidity and premature mortality e.g. cardiovascular disease, chronic respiratory disease and gastrointestinal disease. These diseases can be found in obese children as young as five as Ebbeling et al., (2002) note in their study. So far, the model suggests that the relationship between SES and health is one directional however, this is not the case (Adler & Ostroves, 1999). The model has been critiqued by other scholars for its simplicity. Adler and Ostroves (1999) agree in that health status could also have an impact on SES meaning that the arrows flowing in the model below could also be turned in the opposite direction. 'We also find the effects of childhood SES on adult health, apart from adult socioeconomic level' (Adler & Ostroves, 1999, 8)

As this study looked at children, it was assumed that the socioeconomic status of the parent is that of the child. Years of schooling is often excluded in socioeconomic status; however, it was an important variable to look at as it could prove to have a significant impact on childhood obesity. In this case, we used years of schooling of the parent/guardian. It was also interesting to see the relationship between the children's years of schooling, the parents/guardians thereof, and the impact on obesity/overweightness. Important to note, years of schooling also has an effect on employment status. These variables are at the individual level and are usually only moderately correlated with one another (Adler & Ostrove, 1999).

Over and above the individual level SES factors, the model also identifies external factors that may affect health and illness. These are; social environment, as explained by Swinburn (1999) who coined the term 'obesogenic environment' (Swinburn et al., 1999), external environment, and resources (Adler & Ostrove, 1999) which also ties into Swinburn's et al. (1999) argument of the 'obesogenic environment' (Swinburn et al., 1999). Social environment speaks to one's surroundings conduciveness or lack thereof to acquiring obesity/early onset obesity. These factors could be either at the individual or community level. Environment also refers to the availability of resources, for instance being in a low-income environment shapes health behaviours. Lower income neighbourhoods tend to have more alcohol stores, less access to gym, and less access to nutritious food. (Adler & Ostrove, 1999). These environmental demands can shape one's psychological responses, which become more permanent ways of responding, which also have an impact on health/illness (Adler & Ostrove, 1999). If for example, one's environment is saturated with criminal activity, the individual is likely to be untrusting and fearful of others. This can manifest itself into cardiovascular diseases stemming from chronic sense of hostility (Adler & Ostrove, 1999). The above then determines the way in which individuals behave. The interaction of individual characteristics and environmental demands will determine the extent to which, for instance; one smokes, drinks, exercises or watches their diet (Adler & Ostrove, 1999).

The extent to which individuals feel stressed due to individual factors/environmental will have an impact on their Central Nervous System (CNS) and endocrine responses, which in turn can have long-term effect on chronic illness (Adler & Ostrove, 1999). Different levels of carcinogens and pathogens in one's environment can lead to the early onset or rapid progression of disease (Adler & Ostrove, 1999).

Figure 1. Model of Pathways showing effect of SES on Health/Illness



Source: Adler & Ostrove, 1999: 12

Adler & Ostrove (1999) agree in that the model was over simplified. There could be a feedback loops from Health and Illness going backwards, indicating that the relationship can work both ways. For instance, poor health can influence behavior, which in turn influences cognition, which in turn influences income. This model assumes that the relationship is one directional, which is not always the case. The causal relationship does not matter for this study as it looked at the association between SES and childhood obesity.

1.4 Structure of the dissertation

The thesis consists of five chapters namely: Introduction, Literature Review, Methodology, Findings, and finally the Discussion and Conclusion. The study will focus primarily on the relationship of childhood obesity and socioeconomic factors in South Africa, whilst also bringing light to the four different levels of Body Mass Index (BMI) namely: underweight, middleweight, overweight, and obesity and their relationship to socioeconomic factors.

Chapter Two

Literature Review

2.1 Introduction

It has been documented in multiple papers that obesity has indeed become a worldwide epidemic. This statement can be traced as far back as the year 2001; Wang (2001) noted that obesity had become a 'global epidemic in both industrialized and developing countries' (Wang, 2001, 1129). Despite its early recognition, the prevalence of childhood obesity only seems to be getting worse. South Africa is in the midst of an epidemiologic transition which is characterised by 'simultaneous occurrence of epidemic infectious diseases and a rise in non-communicable diseases, in a population facing heavy burden of perinatal and maternal disorders' (Mayosi, Flisher, Lalloo, Sitas, Tollman, & Bradshow, 2009, 1). Furthermore, it has been predicted that this multi-burden of diseases will be on a steady increase if we do not take the necessary steps in order to combat it (Mayosi et al., 2009). It should be noted that this trend is further exacerbated by the fact that the prevention and treatment of NCDs has been somewhat marginalized due to the high prevalence of infectious diseases such as; HIV/AIDS and Tuberculosis, thus posing another challenge for curbing the spread of childhood obesity among other NCDs. The following research paper aimed to bring immediate awareness to this marginalized disease by providing up-to-date statistics on the prevalence of childhood obesity in South Africa as well as establish the relationship between this disease and socioeconomic factors.

2.2 Background

In the year 1999, this epidemic was seen as one of the most pressing nutritional issues facing children thus requiring immediate attention. It is now the year 2016 and the childhood obesity epidemic only seems to be getting worse. Perhaps the most comprehensive study to date on childhood obesity in South Africa was the study done in the North West province (Kruger et al., 2005). However, 'the impact of rapid process of socioeconomic development during the 1990's of nutritional status is poorly understood' (Jinabhai, Taylor & Sullivan, 2003, 359), my

study aims to help better understand the role that socioeconomic status plays in childhood obesity. Kelishadi (2007) states, 'the incidence if chronic disease is escalating much more rapidly in developing countries than in industrialized countries' (Kelishadi, 2007, 62), indeed childhood obesity should be of 'utmost public health concern' (Daniels, 2006, 47). The presented study aims to increase awareness of the risk factors for childhood obesity, identification of these risk factors is important as Reily et al. (2005) note, 'the identification of risk factors is the key to prevention' (Reily et al., 2005: 1).

The longitudinal study of parents and children done in the United Kingdom proves that the 'obesogenic environment' (Kruger et al. 2005, 352) in early life can determine the risk of obesity later in life (Reilly, Armstrong, Dorosty, Emmett, Ness, Rogers, Steer & Sherriff, 2005). According to Kruger et al. (2005), 'an increasing trend of chronic energy deficiency coexisting with obesity is evident in many lower income/developing countries such as China, South Africa, Vietnam, Brazil (Kruger et al. 2005, 352). This emphasizes the urgent need for the presented study in South Africa.

2.3 Parental Socioeconomic status and childhood obesity

Various authors (Huang, Drewnowski, Kumanyika & Glass, 2009; Kruger, Kruger & McIntyre, 2005; Adler & Ostrove, 1999; Martínez-Vizcaíno, Solera-Martínez, Cavero-Redondo, García-Prieto, Arias-Palencia, Notario-Pacheco, Martínez-Andrés, Mota, Sánchez-López, & Cuenca Study, 2015) have indeed documented the influence of our surrounding environment, culture, biology, psychology and SES factors on childhood overweight/obesity and health. Few have spoken about parental SES and childhood obesity at length. In their study, Martinez-Vizcaino et al. (2015) retrospectively examined two cohorts: 1999-2000 and another from 2008-2009. They found that association of SES and childhood obesity/underweight was shifting. In the 1999-2000 cohort childhood obesity was more prevalent in families of low SES and more prevalent in families with high SES in the 2008-2009 cohort (Matinez-Vizcairo et al., 2015). Children examined in the 1999-2000 cohort had a mean age of 9.5years and children examined in the 2007-2008 cohort had a mean age of 5.3 years (Martinex-Vizcaino, 2015). This study looked at children aged 5-12 years.

As explained by Adler & Ostroves (1999), in their framework, the influence of social factors both at the macro and at micro level on health is well pronounced. In this study, I looked at the

SEF of the parent, as this inherently becomes that of the child. These can also be called social determinants of health and according to the World Health Organization (2016) these are the conditions in which people are born, live, grow, work, and their age (WHO, 2016). SES can be identified as one of the key determinants of health and or ill health. This study looked at the following SEF variables of the parent: education, income, employment status, and place of residence.

2.4 Years of Schooling

Many papers have found a strong correlation between good health and education (Low et al., 2005). Health outcomes for those with more years of schooling differ significantly with those with fewer years of schooling (Cutler, 2006) these differences in health outcomes also affect mortality rates. According to Cutler (2006) in the year 1999 the adjusted mortality rate of high-school drop outs aged 25-64 was twice as high compared to those with some college education (Cutler, 2006, 1).

Higher levels of education are associated with lower morbidity and mortality rates and vice versa (Ross & Wu, 1995; Cutler, 2006) as already mentioned above. Habits that induce lifestyle diseases such as smoking, excessive alcohol consumption are more prevalent among populations with fewer years of schooling than those with more years of schooling (Cutler, 2006). Studies exploring association between parental SES and disease, where SES is measured using; educational level, income and occupation, and diseases looked at were; asthma, depression and obesity in adolescents found that SES and disease were consistently linearly associated with specifically depression and obesity (Goodman, 1999). “Among the lease affluent, poor quality diets are more likely when mothers have the least education, leading to children with malnutrition and mothers who may be overweight” (Poskitt, 2014, 4).

Ross and Wu (1995) give a theoretical explanation as to why education is associated with good health. Their explanation falls into the following three categories namely:

Work and economic conditions

- It is often the case that people who are well educated are less likely to be unemployed and are more likely to be engaged in full time jobs, enjoy their work, and have relatively higher incomes thus experiencing lower economic hardships (Ross & Wu, 1995).

Social-psychological resources

- Social-psychological resources are more accessible to those who are well educated in a population. This group also has a higher sense of self-control as well as social support in addition to economic resources (Ross & Wu, 1995).

Health life-style.

As compared to the poorly educated group in a population, the well-educated are believed to have healthier lifestyles as they are more likely to exercise, drink moderately, less likely to smoke, and more likely to receive preventative health care rather than curative health care (Ross & Wu, 1995).

In the above theoretical explanation, one can see how education becomes central variable associated with health (Ross & Wu, 1995). This does not discredit the role of income and employment but rather, education is seen as a variable that structures the other two as "it is the key to one's position in the stratification system" (Ross & Wu, 1995; 720).

2.4.1 Employment status and health

The best guides to the effects of mass unemployment can be derived from studies of previous epidemics (Dorling, 2009). A study conducted in the United Kingdom found that the employed population group recovered much quicker from illness as compared to the unemployed, it also found that unemployment increased the rates of depression especially in young people who are often hit the most when employment rates take a plunge (Dorling, 2009).

Employment status is influenced by educational attainment which in turn impacts on income (Ross & Wu, 1995). In a study exploring association between health and employment status Kaleta, Makowiec-Dabrowska, & Jegier, (2008) found that in both men and women, self-rated health was indeed associated with employment status. Self-rated health was three times lower among unemployed men as compared the employed, and among unemployed women self-rated health was one and a half times lower than the employed women (Kaleta et al., 2008) this means that the unemployed report low self-rated health as compared to the unemployed population group.

Monitoring trends and determinants of health is of great importance concerning reducing the inequalities of health (Kaleta et al., 2008). Many professionals believe obesity is a chronic

condition and associate it with other chronic conditions such as hypertension, type II diabetes mellitus, and gall bladder disease (Family Economics and Nutrition Review). A study in China (2016) assessing socioeconomic status gradient (of the parent) of childhood obesity and hypertension revealed that obese children were likely to have mothers who only completed secondary school or below (Ip, Ho, Chan, Ho, Tso, and Nelson, 2016). It was also found that children in neighborhoods of low SES had higher risk of childhood underweight, overweight and obesity (Ip et al., 2016). This speaks to the changing nature of the association of health with wealthy, and developed nations (Puoanei, Tsolekile, Sandersi, and Parkeri, 2008; Ip et al., 2016).

It is difficult to speak of employment status and disregard educational level; these two go hand in hand. In a study of 100 multiple sclerosis patients treated at the clinical center of the University of Sarajevo, full employment status had a positive impact on physical and mental health (Hajric & Alajbegovic, 2014). Therefore, 'employment proved to be an important factor in predicting quality of life' (Hajric & Aljabegovic, 2014, 61). From the above, one can see how employment status and educational attainment have a significant impact on one's health and quality of life. According to Dorling (2009), poor income has just an effect on health as unemployment and education.

2.4.2 Income

The obesogenic environment is in part, made up by the ease of accessibility of certain foods. According to Puone (2008) "factors related to poor eating practices include, easy access to *cheap* unhealthy foods and the relatively *high cost* of healthy foods" (Puoane, 2008, 5). Does this therefore mean that parents/guardians who earn less are expected to have children who are overweight/obese? Does this mean that one would expect to find more overweight/obese children among higher SES bracket? This is what this study will answer. It is important to note that due to the demographic transition and changes in the lifestyle of populations brought about by urbanization, chronic diseases are increasing rapidly in developing nations (Puoane, 2008).

The relationship between health and income has been well documented. Gable and Lutz (2000) found that households with lower annual income tended to have obese children and households earning higher annual income had non-obese children (Gables & Lutz, 2000). In lower middle-income countries (LMIC), the leading cause of death is chronic non-communicable diseases, approximately 80% of NCDs occur in LMIC (including South Africa) (Wu, Guo, Chatterji,

Zheng, Naidoo, Jiang, Biritwum, Yawson, Minicuci, Salinas-Rodriguez, and Manrique-Espinoza, 2015). Furthermore, obesity and childhood obesity are the fifth leading cause for global deaths (Neupane, Prakash, and Doku, 2016). Childhood obesity ends up in children having co-morbidities induced by non-communicable diseases that come with being obese or overweight – these co-morbidities are often carried over into adulthood (Puoane, 2008). Duong and Bradshaw (2016) support the above findings as they found that diabetes (NCD) was significantly associated with living in a middle-income household (Duong & Bradshaw, 2016). It seems non-communicable diseases are no longer diseases of the affluent nations (Poskitt, 2014).

2.4.3 Place of residence

Many studies have proven that place of residence is one of the determinants of health. This is certainly true as place of residence is largely influenced by income and income is a determinant of health. In South Africa, the percentage of Africans living urban areas has increased from 43.3% in 1996 to 47.5% in 2001 (Puoane, 2008). Urbanization is seen as one of the major risk factors concerning acquiring NCDs (Puoane, 2008). Living in urban areas has been identified to increase accessibility to health care services (Kaute-Defo, 2006) however; socio-environmental factors make living in urban areas more conducive to rapid weight gain (Puoane, 2008).

Analyses of the demographic and health countries revealed the consequences of rapid urbanization, as it stands Africa is expected to have 50% urbanization by the year 2020 (Neupane et al., 2016). With urbanization comes the sedentary lifestyle, which has been exhausted in previous studies (Mayosi et al., 2009; Poskitt, 2014; Armstrong *et al.*, 2004; and Kruger et al., 2005). This thesis will determine if obesity is linked to urbanization when SES is improved, as the findings by Kgamphe et al., (1992) suggest.

With urbanization comes sociocultural, ecological and environmental changes (Wang, 2001, Huang et al., 2009) Even the food consumed and way of life changes. The “motorized culture” (Neupane et al., 2016: 7) aids in the reduction of activities among the population, the increased availability of processed foods, cinema houses, video games all play a pivotal role in increasing overweightness and obesity (Neupane et al., 2016). These are more common in urban areas than rural. So although rural areas are geographically disadvantaged in terms of accessing

health care and therefore may experience lack of appropriate health care, the demographic transition is making urban areas just as vulnerable to NCDs as rural areas.

2.5 Childhood obesity and Obesity

Obesity is caused by an imbalance in energy intake and energy expenditure in the body (Huang et al. 2009). The magnitude of the energy imbalance seen in today's population according to Huang et al. (2009), 'arises from a complex interaction of biological susceptibilities and socio-environmental changes' (Huang et al. 2009, 1).

Policies and interventions aimed to tackle childhood obesity and obesity should target not only individual biology but also the contextual issues mentioned briefly above. Obesity and childhood obesity are highly determined by the type of behaviour one adapts – behaviour is determined by an array of different individual level factors and socio-environmental factors such as; cultural, physical, economic environment that 'enable or constrain human behaviour or both' (Huang et al. 2009, 1). Adler & Ostrove (1999) also support the above.

Shortly after Cole, Bellizzi, Flegal, Dietz (2000) developed an international standard definition for child overweight and obesity, the World Health Organization urged all countries to examine childhood obesity using a 'standardized international standard' (Wang, 2001). The realization of the prevalence and severity of childhood obesity can be traced approximately two decades back, yet not much of a behavioral change can be witnessed to date (Kruger et al., 2005). To substantiate the above point, in 2006 childhood obesity was declared 'a rapidly growing threat to the health and well-being of populations in countries worldwide' (Kruger et al., 2005, 351) one would expect that by this time the prevalence rate would have been starting to stabilise, unfortunately this is not the case. Kruger et al. (2005) coined the term 'obesogenic environment' which refers to the kind of passive, inactive and overeating environment that causes children to become overweight or obese (Kruger et al., 2005). Kruger et al. (2005) conducted a study in the North West province in South Africa to determine the prevalence as well as determinants of overweight and obesity of 10 – 15-year-old children. Kruger et al. (2005) looked at six variables namely; energy intake, total fat intake, age, physical activity on weekdays and weekends and family size (the number of people in each family) (Kruger et al., 2005, 354). This study found that 7.8% of children were in fact overweight and obese, and the prevalence was higher among females and white children and childhood obesity was 'more

apparent in urban areas, smaller households and children of parents with low or high income occupations' (Kruger et al., 2005, 351).

It has been noted that effective sustainable obesity prevention measures among youth have been elusive (Huang et al., 2009). According to Huang et al. (2009) 'To a great extent, this is the result of a complex task of trying to change the way people eat, move, and live, and sustaining those changes over time' (Huang et al., 2009: 1). These are a combination of social, environmental and psychological factors mentioned in the theoretical framework underpinning this study (Adler & Ostrove, 1999). Two decades ago, obesity was recognized as, 'a major public issue' (Huang et al., 2009: 1) the lack of success in creating and implementing effective preventative measures till this date may exacerbate the prevalence of obesity and childhood obesity.

'Obesity as a function of biology' (Huang, 2009, 3) Huang (2009) explains that the imbalance of energy intake and expenditure is the cause of obesity; this statement has been exhausted in literature on obesity. Naturally as human beings we are driven to sustain the body by providing it energy through the consumption of food. However, Huang (2009) takes it a step further in saying that when copious amounts of *cheap* foods (high-fat, high-sugar) are readily available in our environment this promotes obesity and thus 'failures in weight loss attempts are in part, the result of powerful biological drives to store and maintain energy in the body' (Huang, 2009, 3). Thus distorting the balance of energy intake and expenditure. Animal studies have also shown that parental manipulations tend to promote offspring obesity by permanently altering the way in which they perceive food intake and energy expenditure (Huang, 2009).

Our built environment indirectly pushes us towards certain eating patterns through the way certain foods are marketed and even by constraining food choices or by 'modulating biological processes to affect eating' this is what Huang (2009) notes as 'obesity is a function of the built environment' (Huang, 2009, 4). The availability of fresh produce is limited, for example in the poor and rural communities of the United States of America. Marketing of high calorie foods particularly geared towards children has increased the purchasing and consumptions of such foods that exacerbates childhood obesity – they even have "kiddies sized" Fanta and Coca Cola's in shops now. Huang (2009) note that many features of our built physical environment may be a hindrance to increasing energy expenditure such as: lack of perceived safety, lack of facilities, inadequate transportation to access key destinations and so forth (Huang, 2009) thus

creating that 'obesogenic environment' (Kruger et al., 2005) mentioned earlier. This also ties in with Adler & Ostroves framework (1999) in which an unsafe environment [neighbourhood] can lead one to lead a rather sedentary lifestyle. The relationship between built environment and obesity is poorly understood however, with the emergence of geographic information systems technology 'studying the built environment with objective measures in relation to obesity is now more feasible' (Huang, 2009, 4).

Obesity is also a function of the *social* environment (Huang, 2009) for instance; an overweight child in some cultures can be viewed as a symbol of good health. Cultures also vary in their perceptions of beauty – these views can have an impact on weight loss or the attempt of the prevention of obesity. In South Africa for example, an African woman is deemed more attractive if they have a voluptuous body and with the burden of HIV/AIDS, being lean or too lean is culturally directly associated with this disease.

Some studies reveal a relationship between poverty and obesity; however, this revelation is highly dependent on the area in which the study has been conducted. Which is why this study included *place of residence* as a variable. For instance, in developed countries (eg: United States of America) the trend is that higher rates of obesity are found among those in the higher income groups (income is associated with place of residence). Whereas in developing countries, higher rates of obesity are found in the lower income groups, this suggests that obesity is also a function of *economics* (Huang, 2009, 5). One of the explanations for these opposing observations, 'is that low-income groups in the United States and high income groups in developing countries are either better able to afford or have greater access to energy-dense but nutrient-poor foods…therefore a testable hypothesis linking macro-level economics to obesity is that the higher cost of healthy food may lead to financial stress' (Huang, 2009, 5) as nutrient rich diets have a higher cost per calorie.

> 'This coupled with the higher availability, accessibility, and marketing of unhealthy foods in poorer neighbourhoods, may lead to increased purchase and consumption of unhealthy foods, which over time results in increased obesity' (Huang, 2009: 5).

2.5.1 Summary

The above highlights how biology, built environment, social environment and, economics all play a vital role in the incidence as well as prevalence of obesity/childhood obesity. Although my study will be looking at the relationship between socioeconomics and childhood obesity, it

is evident that eating behaviours are influenced by an array of socio-environmental factors and powerful biological processes that cannot be studied all at once.

This chapter highlighted the pathways in which this thesis attempted to examine the etiology of childhood obesity in order to create the foundation for the study findings. It did this by highlighting the association of chronic illness and the following socioeconomic factors: income, place of residence, and years of schooling. Parental socioeconomic status was discussed because a child adopts the SES of the parent/guardian.

Chapter 3

Methodology

3.1 Introduction

The following chapter will explain the primary data used for this thesis, which is, the National Income Dynamics Study (NIDS). It will also explore the various variables used to define socioeconomic status, as the purpose of this study was to explore the relationship between childhood obesity and socioeconomic factors in South Africa. It will also discuss the research design as well as the method of data collection employed by NIDS.

3.2 The National Income Dynamics Study

3.2.1 Background

The National Income Dynamics Study is a large panel survey born out of the need for the country to understand and track the influences that aid individuals and households to escape or move out of poverty. Panel surveys allow us to track, in real time, individual's life transitions (e.g. school to work) and allow a country to have a repository of data across demographics which can be used for various types of analysis. Not only had the implementation of the NIDS been instrumental in documenting socioeconomic status and lived experiences of the South African population, but the NIDS also allows us to track health outcomes over time - these are good predictors of mortality.

Currently, there are four waves of the NIDS data. The data collection process started in 2005, and in 2006 the South African Labor and Development Research Unit (SALDRU) was selected as the agency to implement the panel survey of which the first wave was conducted in 2008, followed by wave two in 2010/2011, wave three in 2012, and wave four in 2014. Valuable lessons have been learned from each wave, and those lessons have been used for the improvement thereof. Important to note, that large panel surveys do not engage *all* members

of the household and often the household head and one individual is considered for an interview. Having said that the NIDS data gives a rather true reflection of South Africans as on average four member per household are interviewed. However, individuals living in institutions such as prisons, hospitals, and hostels are left out of this panel survey.

Wave three saw a shift in interviewing techniques, NIDS moved away from the conventional methods of interviewing and used computer assisted personal interviewing (CAPI). Para data on the interviewer's performance was also collected which not only improved the quality of the data being collected but also aided in the reduction of interviewer effects. CAPI has aided significantly in the tracking of sample members who were lost in wave two due to insufficient information collected, this has also aided in the consistent improvement of individuals interviewed in wave three of NIDS as will be discussed in the sections to come.

3.2.2 Sample Design

The original NIDS sample was selected back in 2008. 10 367 dwellings were selected from 400 primary sampling units (PSU) of which 10 858 households were successfully interviewed and 31 144 individuals were identified within these households. Important to note, although the PSUs are distributed across provinces in the table below – no analysis can be done within each province as the sample is not representative by province. It is possible for an individual to be a member of more than one household meaning; duplicates are present in the NIDS data set.

Table 3.1.1: Provincial distribution of Primary Sampling Units

Province	No. of PSUs
KwaZulu-Natal	86
Gauteng	48
Mpumalanga	30
Limpopo	38
Free State	31
North West	35
Eastern Cape	53
Northern Cape	27
Western Cape	52
	400

(NIDS, 2015: 20)

3.2.3 Response Rates from wave 1 – 3

The number of individuals being interviewed has grown consistently over the three waves. NIDS emphasizes the importance of tracking continuing sample members (CSM) as they move (internally) around the borders of South Africa. CAPI was instrumental in tracking individuals who have moved from their previous addresses as documented in wave one and two. CAPI recorded the new addresses of the individuals and or households and recorded them. Temporary sample members (TSM) are those member co-resident with the CSM therefore are not interviewed in all waves, only CSMs are interviewed in each wave. The above is depicted in table 3.1.2 below.

Table 3.1.2

Table showing number of continuing sample members and temporary sample members

		Wave 1	Wave 2	Wave 3
Wave 1	CSM	26776	22058	22375
Wave 2	CSM		908	887
	TSM		5585	3223
	CSM			1067
Wave 3	TSM			5081
Total successful individual interviews		26776	28551	32633

(NIDS, 2015: 20)

3.2.4 Non-response rates

Various techniques were used in order to reduce non-response rates, these included; valuing panel members, tracking systems, call backs, new field status was added for respondents who were temporarily away, field organizations were given awards based on performance, CAPI was pre-populated, and a new "no one at home" policy was introduced. The non-response variable for adults is recorded under variable *w3_a_outcome* in wave three of NIDS, these records have a value greater than one. There were 1028 children that had no data beyond section A in wave three due to their unwillingness to participate in the study, this is recorded under *w3_c_outcome* variable. *Table 3.1.3* below shows the non-response rate and how it improved from wave 2 to wave three. In Wave two, all 2875 individuals classified as "non-response" responded in wave three. The non-response rate for TSMs is 43% higher than the CSMs. This is due to the fact that TSMs are not followed if they move out of CSMs homes or the CSMs leave them.

Table 3.1.3 Wave three adult interview outcomes (15 years and older)

Interview Outcome	Frequency	Percent	Cumulative %
Successfully Interviewed	18 710	83	83
Refused/Not available	435	2	85
Household Level Non-response	3 289	15	99
Moved outside of SA	47	0.2	100
Total	22481	100	

(NIDS, 2015: 21)

The above variable is recorded under *w3_a_outcome* variable on Stata. It shows that 83% of the adults (15 years and older) were successfully interviewed, the refusal rate was at approximately 2%, the household level non response rate was at 14%, and less that 1% of the continuing sample members had moved outside the country and therefore could not be interviewed.

Table 3.1.5 Reasons for attrition between waves two and three

Reason	Number	Percent
Refusal	2405	44
Non-contact	2279	42
Deceased	756	14
Total	5440	100

(NIDS 2015: 21)

The table above highlights the reasons for attrition between wave two and three. Almost half the attrition rate is accounted to refusal to participate, and 13% of attrition is due to death of the continuing sample members.

Table 3.1.6 Attrition rates by race

Population Group	Refusal	Non-contact	Deceased	Total	Attrition Rate
African	1300	1748	628	3676	13%
Coloured	480	282	97	859	18%
Asian/Indian	122	41	5	168	36%
White	503	208	26	737	50%
Total	2405	2279	756	5440	16%

(NIDS 2015: 22)

The highest attrition rate can be see among the white population group; non-contacts are also a dominant reason for attrition especially among the African population group – all of which is consistent with the findings in wave two.

3.3 Hypothesis

As mentioned in earlier sections, the study seeks to find out whether there is a relationship between socioeconomic factors and childhood obesity. The following are the null and alternate hypothesis:

Ho: There is no relationship between childhood obesity and socioeconomic factors in South Africa.

Ha: There is a relationship between childhood obesity and socioeconomic factors in South Africa.

3.4 Research Questions

a.) What is the prevalence of childhood obesity in South Africa?

b.) What are the demographic variables associated with childhood obesity?

c.) Is there a relationship between childhood obesity and socioeconomic factors in South Africa?

d.) To what magnitude do socioeconomic factors effect childhood obesity rates in South Africa?

3.5 Outcome variable (Dependent variable)

To determine childhood obesity, BMI of all the children interviewed in the NIDS (2012) was calculated by taking the weight of each child and dividing it by their height squared, as depicted in the formula below. Important to note, BMI was used as a proxy for obesity in this study.

BMI = weight (kg) / [height (m)] 2

BMI was calculated using the recommended Centre for Disease Control (CDC) standard cut-off points for children, this was done separately for boys and a girls aged 5 – 12 years, and calculated at each age interval. The cutoff point for childhood obesity that was used in this study was the 95^{th} percentile for boys and girls (Centre for Disease Control and Prevention, 2015). Since measurements of weight and height were taken twice during data collection, an average weight and height was calculated and used in this study. BMI was extracted from the anthropometric measures section of the child questionnaire form of NIDS.

G4.1: *Child's height 1*

G4.2 *Child's height 2*

G5.1: *Child's weight 1*

G5.2: *Child's weight 2*

The below were combined to form the dummy variables for each BMI category

0 = not obese or overweight

1 = obese or overweight

0 = not obese	0 = not overweight
1 = obese	1 = overweight
0 = not underweight	0 = not middle-weight
1 = underweight	1 = middle-weight

A multivariate analysis was done to determine the prevalence of childhood obesity as well as the strength of the relationship between childhood obesity and socioeconomic factors using multivariate binary logistic regression, this gave an indication of which variable in socioeconomic status was more likely to be associated with childhood obesity and overweight.

The socioeconomic variables looked at were as follows: marital status of the parent, income of the parents, place of residence, employment status of the parent, educational achievements of the parent and the child, and the race of parents and child. Other variables that could have influenced the relationship between socioeconomic factors and childhood obesity were accounted for during regression, these included: marital status (of the parent), race, and gender.

3.6 Employment status (Independent variable)

Employment status has a positive effect on health (Sabanagic-Hajrik & Alajbegovic, 2014). According to Dorling, "the direct effect of reducing unemployment has been estimated to prevent up to 2500 premature deaths a year (Dorling, 2009, 3). This is because employment allows one access to health care.

According to Nattrass (2002), employed individuals are those who have performed some kind of work within a reference period of one week prior to the questionnaire being administered. The nonprofessional's understanding of the term unemployment is simply; being without a job. However, the more technical definition of unemployment can be further broken down into two categories (strict/narrow and broad), in other words employment status can be defined as follows: employed, unemployed, and non-labor-force participants (Nattrass, 2002). Nattrass (2002) also suggests that paid employment and self-employment are the two main categories of employment.

The unemployed population is made up of those that are without work but are currently looking/have looked for work or ways of generating income through self-employment within a specific time frame (in the past), and of course they must be available for work shall the opportunity avail itself. This falls under the strict/narrow definition of unemployment (Nattrass, 2002).

The broad definition of unemployment is similar to the above, except the individual does not require that one be actively searching for work/self-employment. Therefore, the broad definition of unemployment includes those without work and are currently available for work – both of these definitions of unemployment require that an individual be available for work. Lastly, the economically inactive are those that do not fall in all the above categories discussed, baring in mine that the economically inactive does not include those that can work but purposefully choose not to (Nattrass, 2002). This study adopted the broad definition of employment - derived from the below questions in the NIDS study:

E2: *Are you currently being paid a wage or salary to work on a regular basis for an employer (that is not yourself whether full-time or part-time?)*
E38: *Have you engaged in any self-employment activities during the last month?*
E48: *Have you done any casual work to earn money in the past 30 days?*
E70: *How long ago was it since you last worked?*
E79: *In the last four weeks, what are all the things that you have done to search for work or to start a business?*
E9.1: *In which economic sector do you work?*
CE84b: *Is the person currently searching for employment?*

The following parent's occupational statuses were analyzed at in relation to childhood obesity.

1 = Managers
2 = Professionals
3 = Technicians
4 = Clerks
5 = Service and Sales
6 = Elementary

3.7 Household Income (Independent variable)

It is believed that the prevalence of obesity will increase, nutrition quality will decrease, and physical activity will decrease in the face of the economic downturn (Martinez-Vizcaino et al., 2015). One of the aims of this study was to establish the nature of the relationship existing between childhood obesity rates and household income. To solicit this information from the data set, the following question were used to break down income into three categories namely: Lower, middle and upper income.

E12: *Would you say last month's take home was:*
E12.1: *More than or less than R3100*
E12.2: *More than or less than R1300*
E12.3: *More than or less than R5900*
E12.4: *More than or less than R600*
E12.5: *More than or less than R1100*
E12.6: *More than or less than R18000*

3.8 Education (Independent variable)

It has been documented countless times that education level is associated with various health seeking behaviors, which is evident in high levels of self-reported health and low levels of morbidity among those with higher education (Ross & Wu, 1995). Education level was derived from the below question in the NIDS:

H1: *What is the highest grade in school that you have successfully completed?*

NIDS requires that the respondent not count the final year of schooling if that year was not successfully completed. In the analysis, education was broken down into four categories as follows:

1 = Primary school
2 = Secondary school (includes diploma/certificate with Matric)
3 = Bachelor's degree &
4 = Bachelor's degree with honors/diploma/certificate AND Masters or PhD.

3.8 Place of residence (Independent variable)

Place of residence of an individual is significantly correlated to their health status. Eberhardt and Pamuk (2004) conclude that with regards to health status, residents from urban areas were far better off as compared to residents of rural areas (Eberhardt & Pamuk, 2004). Infant mortality rates were also considerably higher in rural areas as compared to urban areas, and this is often linked to the level of infrastructure in a given area. This variable was derived from the following question in wave three of NIDS:

A5: *Local area type*

1 = Traditional
2 = Urban
3 = Rural

Control variables used

Other demographic variables used included; gender, marital status, and race in order to give more explanation in the study findings.

Gender

The above mentioned variable was generated using the following question in wave three of NIDS

B2: *What is your gender?*

1 = Male

2 = Female

Parents relationship status

Parents relationship status was used which accommodates the unique living arrangements of couples in South Africa. This was ascertained from the following question in NIDS:

E4: *How would you describe the relationship between the mother and the father of the child?*

1 = Married

2 = Divorced

3 = Living together

4 = Separated

5 = Never dated

6 = one/both dead

Race

Racial grouping was derived from the following question:

B3: *What population group do you belong to?*

1 = African

2 = Colored

3 = Asian/Indian

4 = White

3.10. Data analysis

This study used secondary data derived from the National Income Dynamics Survey, in an attempt to establish the magnitude, or lack thereof, of the association between childhood obesity and socioeconomic factors. Extraneous variables were used in order to determine how much of an impact the independent variable had on the dependent variable. Data analysis was conducted using version 12 of Stata.

In order to determine the relationship between the outcome variable and independent variable, a chi-square test was done to assess whether a significant relationship does indeed exist. Because the outcome variable was categorical, logistic regressions were run, as this method can be extended to incorporate multiple variables. Therefore, logistic regressions were run on each variable to measure the significance of the assumptions made on the multivariable level (Bewick, Cheek, & Ball, 2006). The model was built using the stepwise approach adopted from Hosmer and Lameshow (2000).

A univariate analysis was run for each variable in order to determine the significance of each factor ($p < 0.05$). The multivariable analysis was then built based on the above results. Factors that were found significant were selected to build the multivariable model. The final model was made by testing the goodness of fit of the model using the STATA-13 software program. Command. The below formula was used for the logistic model:

$$\text{Logit}(p) = (a + b1x1) + (b2x2 + \ldots bi\ xi)$$

Obesity was generated from BMI, and was used to determine whether a relationship exists between socioeconomic factors and childhood obesity.

3.10 Assumptions and Limitations of Study

Measurements of weight and height are taken at the time of the interview and are not self-reported this eliminates any bias, which may be associated with self-reporting. However, bias is not completely eliminated as the questions in the questionnaire that deal specifically with socioeconomic status are self-reported such as; educational achievements, income, marital status and so forth. Information on income is often misrepresented and has high non-response

rates. Another limitation is that this study will determine the prevalence of childhood obesity at a certain point in time only. Physical activity was not included in the analysis as the NIDS does not collect this data. Lastly, non-response rates from the White and Indian/Asian population group are significantly low, making it challenging to understand the true extent of prevalence of childhood obesity in the South Africa.

3.11 Expected Outcomes

The expected outcome of this study is not only to find a significant increase in the prevalence of childhood obesity, but also to see a direct relationship between childhood obesity and socioeconomic factors. As mentioned earlier, with urbanization comes the obesogenic environment which exacerbates the increasing trend of childhood obesity therefore, I expect to find more obese children among urban areas as opposed to rural. Many studies have found a positive relationship between obesity and socioeconomic factors in many parts of the world and I expect the strength of this relationship to be determined by socioeconomic status of the child's parent.

3.12 Summary

This chapter attempted to explain the methodology employed in this study in light of the theoretical framework that was presented to the reader in the first chapter. The variables (education, household income, place of residence, marital status, race, and gender) looked at in the study and relevance thereof were described in depth. The following section aims to bring forth the findings of this study.

Chapter Four

Results

4.1 Introduction

The following chapter presents the findings drawn from the National Income Dynamics Study. Few studies have focused on the relationship between socioeconomic factors and illness; this has been exhausted in the above sections. The primary focus of this chapter is on highlighting the relationship between socioeconomic factors and body mass index of children aged 5 – 12 years on South Africa. The analysis was guided by the theoretical framework depicted in chapter one of this thesis. This chapter begins with a demographic overview of the study population, followed by the analysis employed and lastly, a narrative and summation of the findings is presented.

4.2 National Income Dynamics Study

The presented study looked at both male and female adults and children (the adults had to be looked at in order to ascertain the socioeconomic background of the child). In other words, the primary focus of the study was the children. There were more girls (50.2%) than boys (49.7%). The racial distribution of the sample is rather un-balanced with the Indian/Asian population group having the least representation (1.4%) followed by the White population group at (5%). This is a challenge evident in most large panel surveys.

With regards to the parents of these children, educational attainment seemed to be rather low among mothers (69%) Primary school highest level passed) as compared with the father (61% Primary school highest level passed). On the contrary, more mothers (8.1%) than fathers (0.8%) had a bachelor as their highest level of education completed. a large proportion of the parents are separated (28%) however, an even larger proportion (37%) are married. With regards to parents occupation, 33% have never worked, 16.79% work in elementary positions, and only 3.9% are Professionals. This speaks directly to the low level of education attained by both mothers and fathers.

Demographic distribution of children and their parents

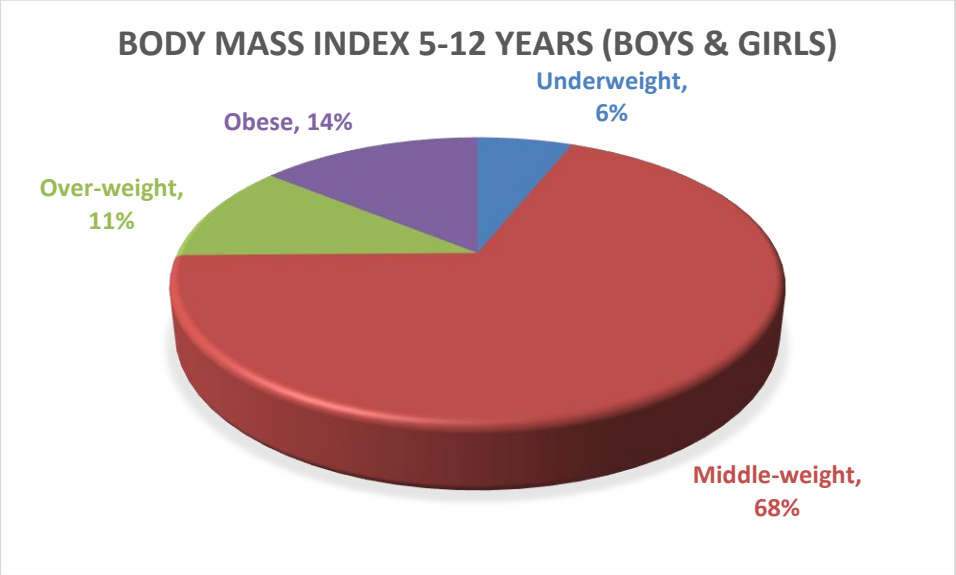
Demographic	**Categories**	**Age group 5-12 % distribution (N=5490)**
Gender	Male	49.7
	Female	50.2
Educational Level	Junior Primary	65.9
	Primary	34.0
Population group	African	85.3
	Coloured	8
	White	5
	Indian/Asian	1.4
Household Income	Lower	14.1
	Middle	44.0
	Upper	41.8
Place of residence	Traditional	42.3
	Urban	52.0
	Farm	56.1
	Parents Information	
Parents relationship status	Married	37
	Divorced	2.4
	Living together	9.5
	Not living together	12.1
	Separated	28.1
	Never dated	1.4
	N/A (one or both dead)	5.8
Parent's occupation	Managers	0.56
	Professionals	3.98
	Technicians	0.72
	Clerical support	2.04
	Service and sale	7.99
	Agriculture, fishing	0.06
	Craft and trade	0.88

	Plant, machine ops Elementary Never worked	0.60 16.79 33.01
Mothers' education level	No schooling Primary Secondary Bachelor Bachelor Plus	3 69.4 21.5 8.1 0.84
Father's education level	No schooling Primary Secondary Bachelor Bachelor Plus	 61.2 30.1 0.8 11.9

Few studies have documented the relationship between childhood obesity and socioeconomic factors among South African children. Due to this reason, this study had a special focus on *children* (5-12years) BMI was calculated separately for each age group and for boys and girls – of which will be presented in the following section. In order to calculate obesity, one needs to start by calculating BMI, BMI has four levels namely; underweight, normal-weight, over-weight, and obese. BMI is calculated differently for children as compared to adults. For children 0-20 years the categories of BMI differ at each age as well as between boys and girls, this study adopted the International Obesity Task Force (IOTF) Cut off points (Cole *et al.*, 2000).

Figure 4.1 below gives a visual representation of the combined body mass index across ages 5 – 6 years in girls and boys. The obesity rate among children in South Africa is 14%, while overweight rate is 11%. Figure 4.2 shows how the largest obesity rates are found in the lower ages (5-6) among boys and girls. The obesity rate among 5-year-old girls is 30% and 25% respectively.

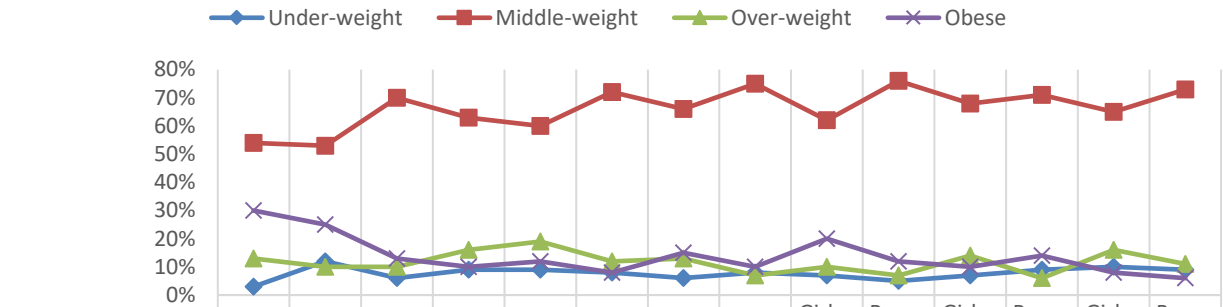
Figure 4.1 BMI distribution of 5-12 years



NIDS (2012a) weighted

Figure 4.2 below is a graphical representation of BMI at each age interval, seperated for boys and girls. Obesity is shown to be highest among the five year olds for both girls and boys, it also peaks at age 10 (20%) for girls. Underweightness is highest at age 5 (12%) among the boys and higehst for girls at age 12 (10%).

Figure 4.2 BMI for age, boys and girls



	Girls - Age 5	Boys - Age 5	Girls - Age 6	Boys - Age 6	Girls - Age 7	Boys - Age 8	Girls - Age 9	Boys - Age 9	Girls - Age 10	Boys - Age 10	Girls - Age 11	Boys - Age 11	Girls - Age 12	Boys - Age 12
Under-weight	3%	12%	6%	9%	9%	8%	6%	8%	7%	5%	7%	9%	10%	9%
Middle-weight	54%	53%	70%	63%	60%	72%	66%	75%	62%	76%	68%	71%	65%	73%
Over-weight	13%	10%	10%	16%	19%	12%	13%	7%	10%	7%	14%	6%	16%	11%
Obese	30%	25%	13%	10%	12%	8%	15%	10%	20%	12%	10%	14%	8%	6%

NIDS (2012a) weighted

Exploring the relationship between body mass index (among children) and socioeconomic factors in South Africa

Figure 4.3 shows the distribution of BMI by place of residence. In rural areas the obesity rate is the lowest (1%) whilst highest in urban areas (8%) whilst underweightness was non-existant in rural areas. This finding is consistant with the 'obesogenic environement' (2005) notion identified in the North West study (among urban populations) as a determinant of obesity and overweightness among 10-15 years old children and adolescents. Overweightness was also high in urban areas (6%) followed by traditional areas (5%). Middleweightness is highest in urban areas (34%) followed closely by traditional areas (30%). Females are depicted to have a higher prevelence of obesity as compared to boys, this is also presented in ***figure 4.3*** below.

Figure 4.3 BMI by gender

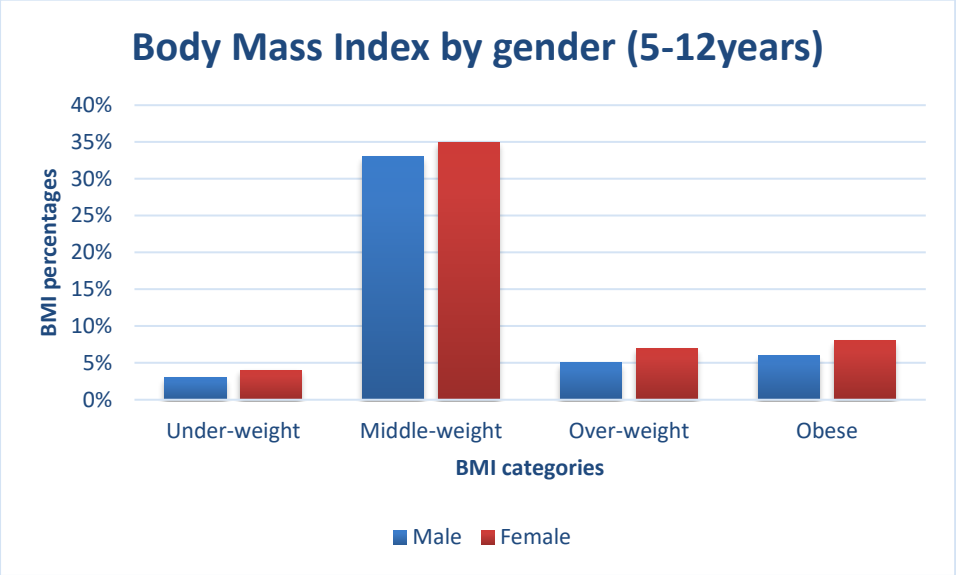


Figure 4.4 shows the distribution of BMI over race, obesity, overweightness, and underweightness in children 5-12 years is highest in the African population at 12%, 10%, and 5% respectivley. No observations were seen in obesity, overweight and underweight in the Indian/Asian population group, and few observations were seen in the White and Colored population group.

Figure 4.4 BMI by race

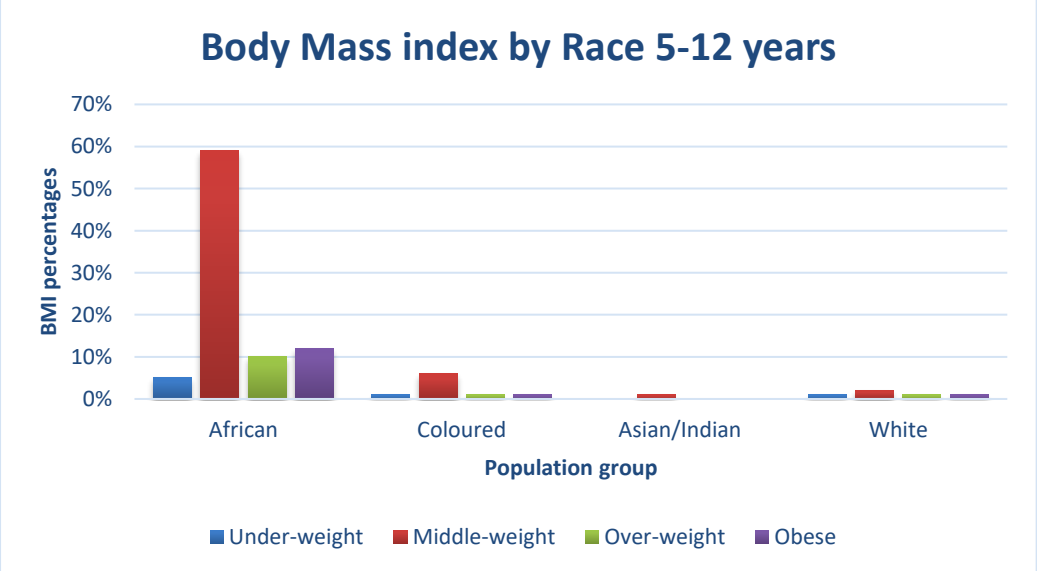


Figure 4.5 shows the distribution of BMI over place of residence. The highest rates of obesity can be observed in the Urban areas (8%) and the lowest rates are observed in rural areas (1%). Interestingly, underweight is also highest in Urban and Traditional areas, both at 3%. No observations of underweightness were seen in rural areas.

Figure 4.5 **BMI by place of residence**

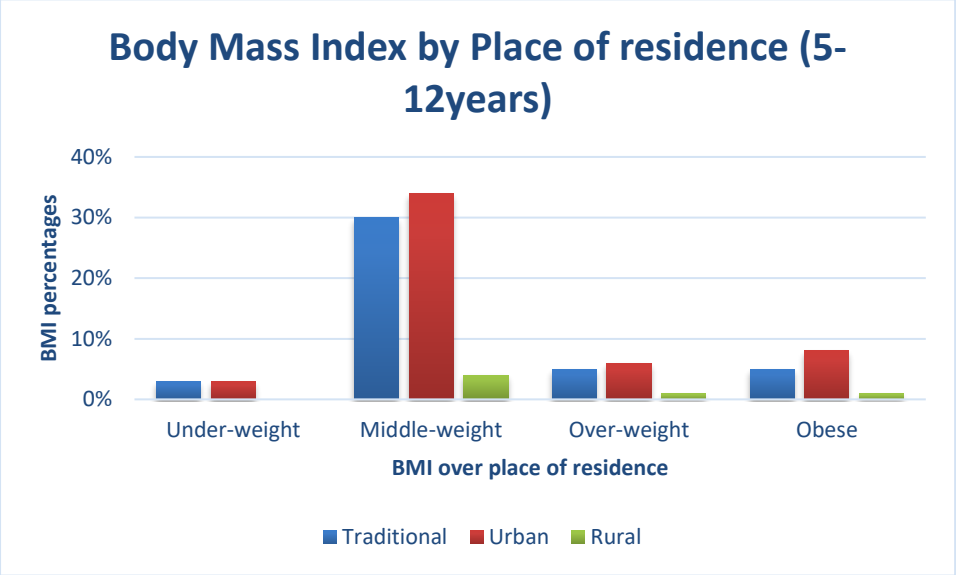
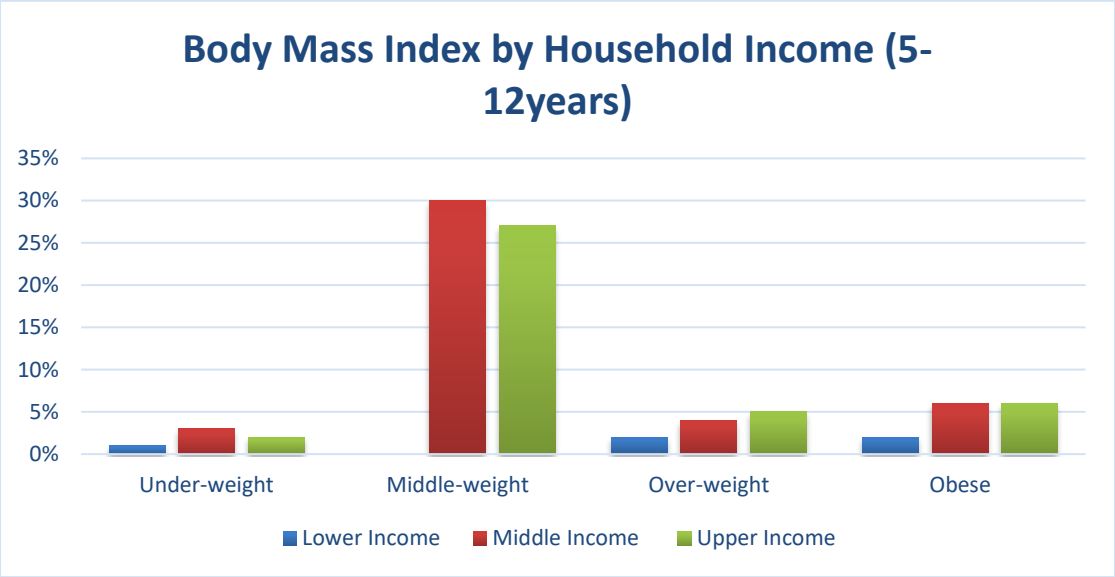


Figure 4.6 below shows the distribution of BMI across the different levels of household income. Overweightness is highest among households in the high income bracket (5%) whilst under-weight is most prevalent in the middle income group (3%). However, it is important to note that there was a high non-response rate among this question as people often do not divulge information of their income level.

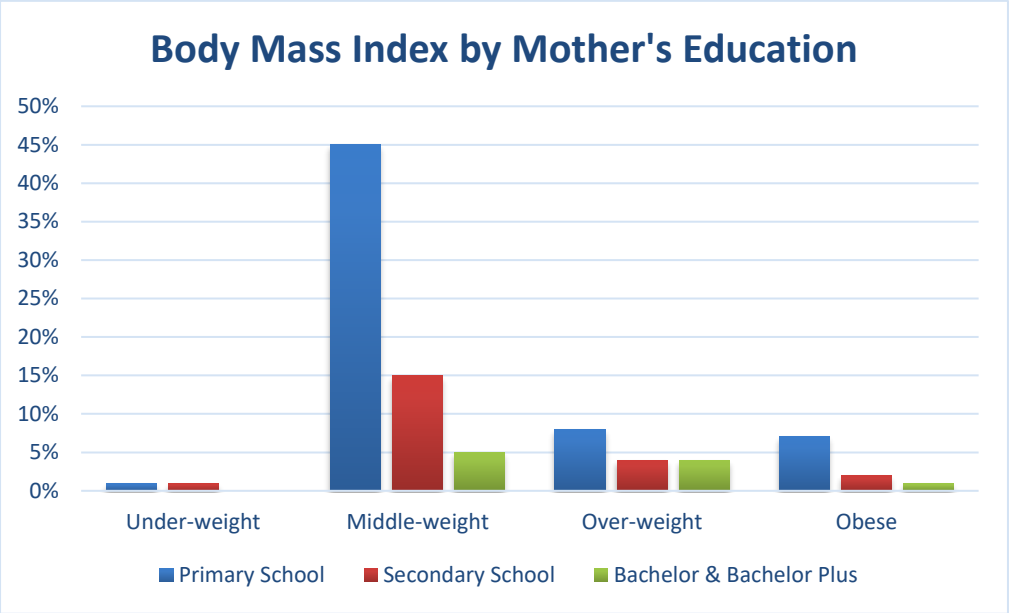
Figure 4.6 BMI by household income



NIDS (2012a) weighted

Figure 4.7: With regards to mother's educational level, it was found that mothers with primary school level of education were most likely to have obese children (7%) whilst mothers who hold a bachelor or bachelor plus level of education were less likely to have obese children (1%). Similarly, overweight levels of children were higher (8%) among mothers with primary school levels of education and lower (4%) among mothers with both bachelor or bachelor plus and secondary school level of education. The BMI distribution over father's education exhibits a similar pattern, this is depicted in ***figure 4.8.***

Figure 4.7 BMI by mother's education



NIDS (2012a) weighted

Figure 4.8 BMI by father's education

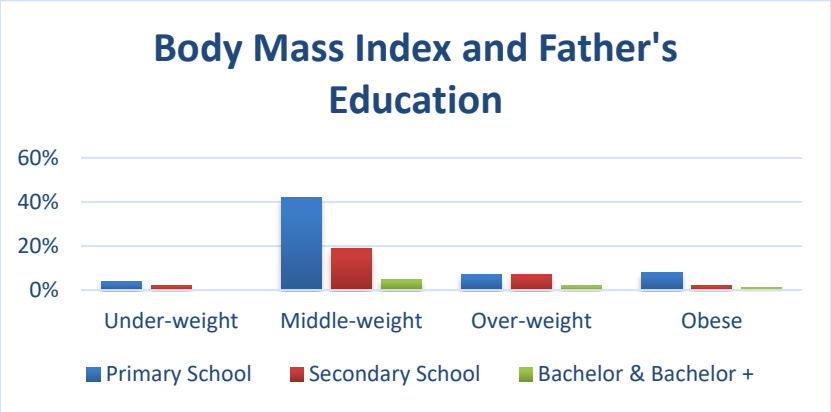
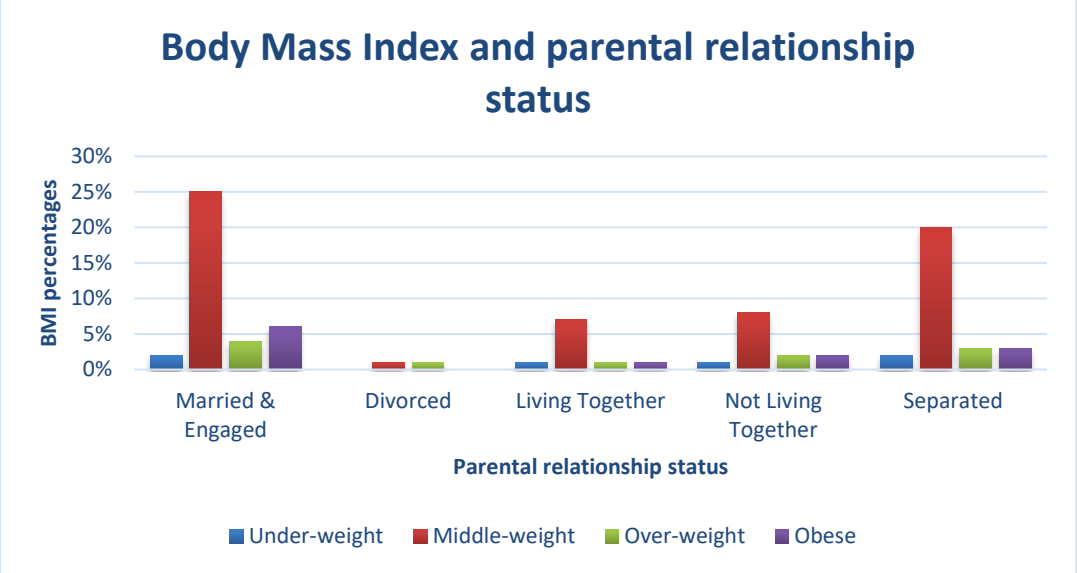


Figure 4.9 below shows the distribution of body mass index by parental relationship status. The highest prevalence of childhood obesity can be seen in children with parents who are married/engaged (6%). Overweightness is also highest in this category (4%), followed closely by the separated category at (3%).

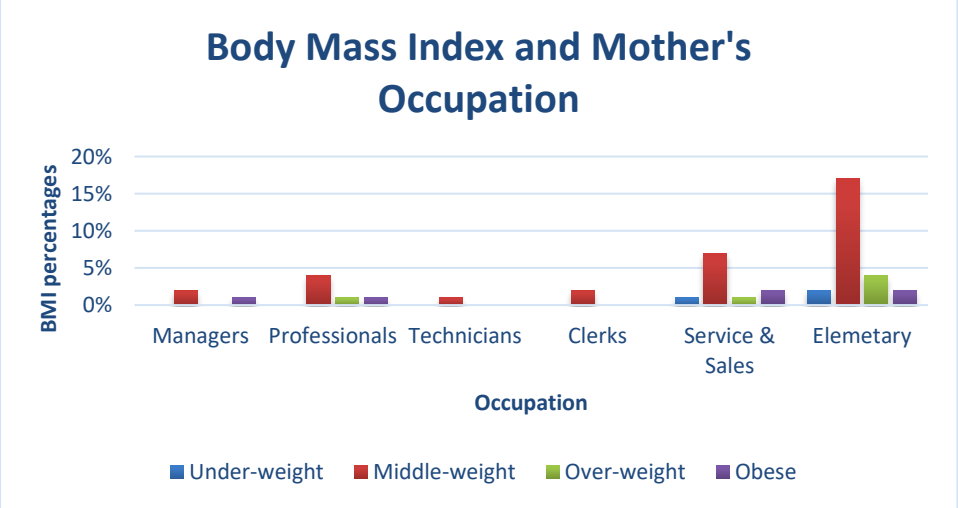
Figure 4.9 BMI by parental relationship status



NIDS (2012a) weighted

The differences in children's BMI can also be seen through the different occupations, as depicted in ***figure 4.10*** below. There was a significant amount of missing data in this question, for both mother's and father's which had an effect on these findings. The overweight rate is seen to be highest among children who have mother who are in elementary occupations (4%), middle weight is also seen to be highest among the same group (17%)

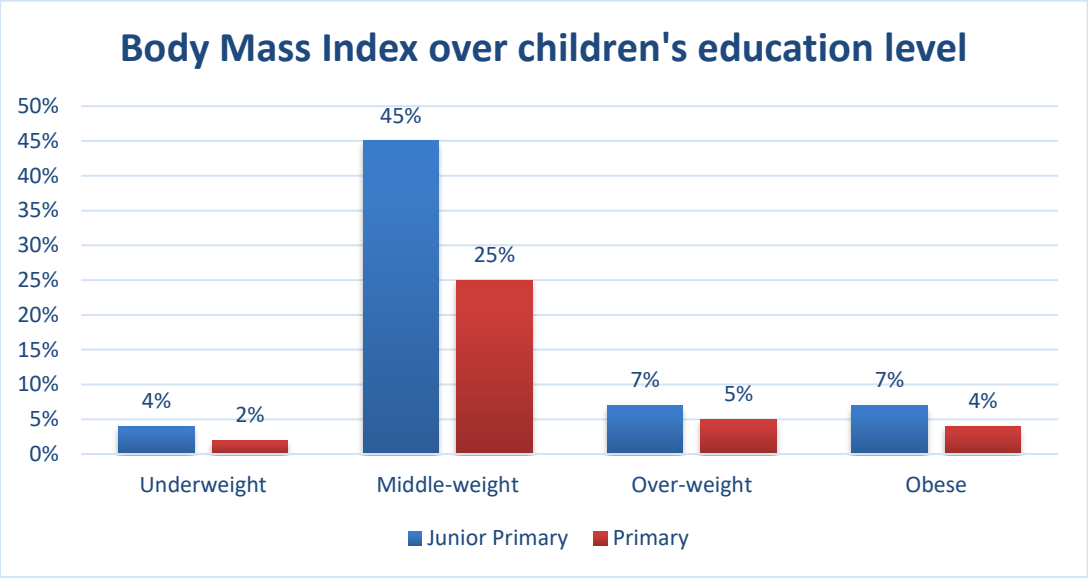
Figure 4.10 BMI by mother's occupation



NIDS (2012a) weighted

Figure 4.11 below shows the distribution of BMI over two school levels namely; Junior primary and Primary school. Obesity and overweight rate are equivalent (7%) in Junior primary school, these results are consistent with the finding presented in ***figure 4.2*** which showed that obesity highest among the youngest age group (5years). Approximately 5% of children in Primary school were overweight, whilst underweight was lowest (2%) among children in Primary school.

Figure 4.11 **BMI by educational level**



NIDS (2012a) weighted

4.4.1 Bivariate and Multivariate analysis

Because this study looked at multiple explanatory variables, a model was built using the step-wise regression (Bewick *et al.,* 2005). Variables that were kept right through to the multivariate analysis were those that were found significant at the bivariate analysis. However, there were very few observations for; mother's occupation, father's occupation, mother's education, and father's education and for this reason, these variables were dropped at the multivariate stage of the analysis. The following tables below show the significance levels of each of the variables used in the study. Bivariate analysis was done for each category of BMI namely; obese, over-weight, middleweight, and underweight.

Table 4.1: Logistic Regression for obese children aged 5-12 years

Dependent Variable	Independent Variable	F	P	Significant factors
Obese children 5-12 years	1. Place of residence	128.11	0.0000	1
	2. Household Income	243.50	0.0000	1, 2
	3. Mothers Education	19.78	0.0000	1,2,3
	4. Father's Education	31.35	0.0000	1,2,3,4
	5. Race	35.85	0.0000	1,2,3,4,5
	6. Gender	259.08	0.0000	1,2,3,4,5,6
	7. Parents relationship status	73.40	0.0000	1,2,3,4,5,6,7
	8. Mother's Occupation	31.57	0.0000	1,2,3,4,5,6,7,8
	9. Father's Occupation	41.93	0.0000	1,2,3,4,5,6,7,8,9

NIDS (2012a) weighted

Table 4.1 above shows the model building of all the variables used in this study – in relation to childhood obesity (5-12), all these were found to be significant and carried forward, goodness of fit of the model was measured and showed significance of the model and showed that the model represented the observed data adequately.

Table 4.2: Logistic Regression for middleweight children aged 5-12 years

Dependent Variable	Independent Variable	F	P	Significant factors
Over-weight children – Ages 5-12 years	1. Place of residence	200.31	0.0000	1
	2. Household Income	368.65	0.0000	1, 2
	3. Mothers Education	7.03	0.0000	1,2,3
	4. Father's Education	5.02	0.1391	Drop variable
	5. Race	64.07	0.0000	1,2,3,5
	6. Gender	315.19	0.0000	1,2,3,5,6
	7. Parents relationship status	88.66	0.0000	1,2,3,5,6,7
	8. Mother's Occupation	28.54	0.0000	1,2,3,5,6,7,8
	9. Father's Occupation	35.91	0.0000	1,2,3,5,6,7,8,9

NIDS (2012a) weighted

Table 4.2 above shows the model building of all the variables used in this study – in relation to overweightness of children aged 5-12 years, all but one variable (father's education) were found to be significant and carried forward. Goodness of fit of the model was measured and showed significance of the model and showed that the model represented the observed data adequately. father's educational level was not taken to the multivariate analysis due to the few responses in this category and consequent insignificance of the relationship observed in the bivariate analysis.

Table 4.3: **Logistic regression for middle-weight children aged 5-12 years.**

Dependent Variable	Independent Variable	F	P	Significant factors
Middle-weight – Ages 5-12 years	1. Place of residence	38.89	0.0000	1
	2. Household Income	84.92	0.0000	1, 2
	3. Mothers Education	2.77	0.0094	1,2,3
	4. Father's Education	1.43	0.2039	Drop variable
	5. Race	10.38	0.0000	1,2,3,5
	6. Gender	70.97	0.0000	1,2,3,5,6
	7. Parents relationship status	28.59	0.0000	1,2,3,5,6,7
	8. Mother's Occupation	9.06	0.0000	1,2,3,5,6,7,8
	9. Father's Occupation	13.62	0.0000	1,2,3,5,6,7,8,9

NIDS (2012a) weighted

Table 4.3 above shows the model building of all the variables used in this study – in relation to middle-weight children aged 5-12 years. Again all but one variable (father's education) were found to be significant and carried forward, goodness of fit of the model was measured and showed significance of the model and showed that the model represented the observed data adequately. Similarly, father's educational level was not taken to the multivariate analysis due to the same reasons observed in ***table 4.4.2.***

Table 4.4: Logistic regression for under-weight children aged 5-12 years

Dependent Variable	Independent Variable	F	P	Significant factors
Under-weight – Ages 5-12 years	1. Place of residence	165.44	0.0000	1
	2. Household Income	293.83	0.0000	1, 2
	3. Mothers Education	35.81	0.0094	1,2,3
	4. Father's Education	26.10	0.2039	Drop variable
	5. Race	60.03	0.0000	1,2,3,5
	6. Gender	416.27	0.0000	1,2,3,5,6
	7. Parents relationship status	80.97	0.0000	1,2,3,5,6,7
	8. Mother's Occupation	44.77	0.0000	1,2,3,5,6,7,8
	9. Father's Occupation	41.24	0.0000	1,2,3,5,6,7,8,9

Table 4.4 above shows the model building of all the variables used in this study – in relation to under-weight children aged 5-12 years. Again all but one variable (father's education) were found to be significant and carried forward, goodness of fit of the model was measured and showed significance of the model and showed that the model represented the observed data adequately. Again, father's educational level was not taken to the multivariate analysis due to the same reasons observed in ***table 4.4.2,*** and ***table 4.4.3.***

4.4.2 Bivariate and multivariate analysis of selected variables (Obesity - Table 4.5)

4.4.2.1 Place of residence

The relationship between place of residence and childhood obesity among children aged 5-12 years at the *bivariate* analysis stage showed that children were 82% less likely of being obese in urban areas as compared with children residing in traditional areas, whilst children in rural areas were 87% less likely to be obese than children in traditional areas. Similar findings were observed for the overweight category.

Multivariate analysis showed that children residing in urban areas were 7% less likely to be obese as compared to children living in traditional areas, and children living in rural areas were 26% less likely to be obese.

4.4.2.2 Household income

Children living in households earning an upper income were shown to have 73% less chance of being overweight as compared to children living in lower income earning household. Children residing in middle income earning households were found to be 85% less likely to be obese than children living in lower income earning households. Similar findings were seen in the overweight category of children.

At the *multivariate* level of analysis, children coming from middle income earning households were 66% less likely to be obese and children from upper income earning households were 73% less likely to be obese.

4.4.2.3 Mother's education

Due to the few observations in the bachelor and bachelor plus categories, these two levels of education were collapsed into one category. Children who had mothers with a bachelor/bachelor plus level of education were 87% less likely to be obese than children with mothers with lower education. This variable was found to be insignificant at the multivariate stage of analysis.

4.4.2.4 Race

Amongst children aged 5-12 years, race was seen to play a significant role in obesity as well as over-weight rates; the Coloured population group was 86% as compared to the African population group.

The coloured population group were found to be 92% less likely to be obese at the *multivariate* stage, Indian population group were 99.08% less likely and the white population group was 100.03% less likely to be obese as compared to the African population group.

4.4.2.5 Gender

The *bivariate* analysis for children aged 5-12 years shows that females were 83% less likely to be obese as compared to males. This was also true in the bivariate analysis for overweight children in the same age category.

Females were found to be 17% less likely to be obese at the *multivariate* stage.

4.4.2.6 Parental relationship status

Parental relationship status was looked at, and more categories than the usual; married, divorced, cohabitating, widowed, and separated categories were looked at in order to fully capture the kind of relationships South Africa is involved in. At the bivariate analysis, children living with divorced parents were 79% less likely to be obese as compared to children living with married parents. Children living with parents who are cohabitating were 89% less likely to be obese; children living with parents who are not living together were 81% less likely to be obese; children with parents who had separated were 89% less likely to be obese and children with parents who were never involved were found to be 78% less likely to be obese.

At the *multivariate* stage children whose parents were divorced were 48% less likely to be obese, children who had parents living together were 97% less likely to be obese, children with parents who were not living together were 42% less likely to obese, and children with parents who had never been involved were 50% less likely to be obese.

4.4.2.7 Mothers occupation

Occupational status of the parents was also found to be significant in the bivariate analysis, however, this did not hold in the multivariate due to few observations observed in this variable. Father's occupation was also left out, as the relationship between childhood obesity/overweight was insignificant at the bivariate analysis. Children with mothers who were professionals were 99% less likely to be obese as compared to children with mothers who were managers whilst children with mothers who were plant and machine operators were 75% less likely to be obese. This variable was found to be insignificant at the multivariate stage.

Table 4.5: Relationship between socioeconomic factors and obesity children 5-12 years

		Bivariate Analysis	Multivariate Analysis
Variables	**Categories**	**Odds Ratio [95% CI]**	**Odds Ratio [95% CI]**
Place of Residence	Traditional	***Reference***	***Reference***
	Urban	0.18 (0.14-0.23) ***	0.93 (0.68-1.27)
	Rural	0.13(0.07-0.22) ***	0.74 (0.41-1.34)
Household Income	Lower	***Reference***	***Reference***
	Middle	0.15 (0.13-0.19) ***	0.34 (0.26-0.44) ***
	Upper	0.17 (0.13-0.22) ***	0.27 (0.20-0.36) ***
Mothers education	Primary	***Reference***	
	Secondary	0.08 (0.03-0.18) ***	
	Bachelor & Bachelor +	0.13 (0.02-0.64) **	
Race	African	***Reference***	***Reference***
	Coloured	0.14 (0.09-0.22) ***	0.80 (0.48-1.32)
	Indian/Asian	0.005 (0.001-0.037) ***	0.02 (0.003-0.17) ***
	White	0.34 (0.14-0.80) *	2.07 (0.87-4.94)
Gender	Male	***Reference***	***Reference***
	Female	0.17 (0.14-0.21)***	0.83 (0.64-1.08)
Parents Relationship status	Married	***Reference***	***Reference***
	Divorced	0.21 (0.094-0.46) ***	0.52 (0.22-1.21)
	Living together	0.11 (0.072-0.17) ***	0.30 (0.17-0.50) ***
	Not living together	0.19 (0.13-0.29) ***	0.58 (0.40-0.85) **
	Separated	0.11 (0.09-0.15) ***	0.30 (0.22-0.42) ***
	Never involved	0.22 (0.09-0.52) **	0.50 (0.17-1.45)
	N/A (one or both dead)	0.16 (0.09-0.25) ***	0.44 (0.24-0.81) *
Mothers Occupation	Managers	***Reference***	
	Professionals	0.10 (0.03-0.27) ***	
	Technicians	0.04 (0.004-0.35) **	
	Clerical support	0.24 (0.07-0.79) *	
	Sales workers	0.17 (0.05-0.50) ***	
	Craft and related trade	0.02 (0.003-0.18) **	
	Plant & machine operators	0.25 (0.03-1.7)	
	Elementary occupation		

	Never worked	0.09 (0.05-0.18) *** 0.11 (0.08-0.16) ***	
Fathers Occupation	Managers Professionals Technicians Clerical support Sales workers Craft and related trade Plant & machine operators Elementary occupation Never worked	***Reference*** 0.08 (0.03-0.18) *** 0.79 (0.11-5.55) 0.10 (0.01-0.50) ** 0.10 (0.06-0.16) *** 0.09 (0.04-0.17) *** 0.14 (0.08-0.23) *** 0.11 (0.05-0.25) *** 0.11 (0.07-0.17) ***	

***p<0.001 **p<0.01 *p<0.05

Table 4.6 Relationship between over-weight and socioeconomic factors

		Bivariate Analysis	**Multivariate Analysis**
Variables	**Categories**	**Odds Ratio [95% CI]**	**Odds Ratio [95% CI]**
Place of Residence	Traditional Urban Rural	***Reference*** 0.13 (0.10-0.16) *** 0.10 (0.06-0.17) ***	***Reference*** 0.62 (0.45-0.86) ** 0.53 (0.30-0.94) *
Household Income	Lower Middle Upper	***Reference*** 0.10 (0.08-0.12) *** 0.15 (0.11-0.19) ***	***Reference*** 0.22 (0.17-0.29) *** 0.34 (0.24-0.48) ***
Mothers education	Primary Secondary Bachelor & Bachelor +	***Reference*** 0.21 (0.10-0.45) *** 0.55 (0.18-1.68)	
Race	African Coloured Indian/Asian White	***Reference*** 0.08 (0.06-0.12) *** 0.03 (0.008-0.17) *** 0.27 (0.11-0.64) **	***Reference*** 0.60 (0.39-0.94) * 0.28 (0.05-1.45) 1.61 (0.70-3.69)
Gender	Male Female	***Reference*** 0.14 (0.11-0.17) ***	***Reference*** 0.79 (0.59-1.06)
Parents Relationship status	Married Divorced	***Reference*** 0.48 (0.21-1.08)	***Reference*** 1.90 (0.82-4.38)

	Living together	0.10 (0.06-0.15) ***	0.38 (0.22-0.64) ***
	Not living together	0.14 (0.10-0.21) ***	0.55 (0.36-0.85) **
	Separated	0.11 (0.08-0.14) ***	0.41 (0.29-0.56) ***
	Never involved	0.17 (0.08-0.34) ***	0.54 (0.22-1.29)
	N/A (one or both dead)	0.11 (0.06-0.19) ***	0.47 (0.27-0.81) **
Mothers Occupation	Managers	***Reference***	
	Professionals	0.22 (0.10-0.49) ***	
	Technicians	0.13 (0.02-0.70) **	
	Clerical support	0.04 (0.008-0.20) ***	
	Sales workers	0.11 (0.05-0.25) ***	
	Craft and related trade		
	Plant & machine operators	0.15 (0.02-0.82) *	
	Elementary occupation	0.16 (0.10-0.28) ***	
	Never worked	0.18 (0.13-0.26) ***	
Fathers Occupation	Managers	***Reference***	
	Professionals	0.23 (0.09-0.57) **	
	Technicians	0.06 (0.007-0.55) *	
	Clerical support	0.25 (0.04-1.56)	
	Sales workers	0.17 (0.08-0.34) ***	
	Craft and related trade	0.12 (0.06-0.22) ***	
	Plant & machine operators	0.11 (0.07-0.18) ***	
	Elementary occupation	0.13 (0.07-0.24) ***	
	Never worked	0.13 (0.09-0.21)***	

***p<0.001 **p<0.01 *p<0.05

4.4.3 Summary

This chapter highlighted the magnitude of the relationship between childhood obesity and socioeconomic factors in South Africa. The bivariate analysis showed significance in the relationship between the parental socioeconomic factors and childhood overweight and obesity among 5-12-year-old children, as presented in the above figures and tables. An important

finding was the high obesity rates observed in the younger age group (age-5) for boys and girls of which, can lead to future research. The following chapter aims to provide a conclusive summary to the findings of this study and provide future recommendations for research in childhood obesity.

Chapter Five

Discussion and Conclusion

5.1 Introduction

There has been a wide-spread growing concern with regards to the increase of the prevalence of obesity among adult populations, more especially in developed nations. Unfortunately developing countries such as South Africa are also beginning to see a significant spike in obesity rates however, there has been less focus on children. It was due to this reason that the focal area of this study was on the age-group 5-12-year-old children. Bringing light to the distribution of body mass index over each age of South African children, will not only highlight the "problem ages" of childhood obesity/overweightness but also encourage health researchers to think of ways of reversing this spike in the numbers of childhood obesity that could end up creating a morbid future generation.

This chapter will discuss the nature of the existing relationship between childhood obesity and socioeconomic factors as discovered in the NIDS data set; it will also provide conclusions that can be drawn from the study findings as well as give recommendations for potential further research on this topic.

5.2 Discussion

Martinez-Vizcairo et al. (2015) noted a trend from 1999-2000 of higher childhood obesity in families of lower SES however, in the 2008-2009 cohort, higher rates of obesity were observed among groups of higher socioeconomic standing (Matinez-Vizcairo et al., 2015). This study is consistent with the findings of Matinez-Vizcairo et al. (2015).

Mayosi et al. (2009) noted that the rise in NCDs will be inevitable - aggravated by the lack of attempts to combat them. The rise in childhood obesity and overweight in South Africa is concerning as it acts as a gateway to developing other chronic diseases such as diabetes and hypertension (Chintu et al., 2005). The findings presented in this study depict the final stages of the nutritional transition, which South Africa is said to be in right now (Mchiza, 2013). Many studies have documented the prevalence of overweight/obesity in developing countries

however, few have linked this to socioeconomic factors (Obong, Ibeanu, Onuoha, & Ejekwu, 2012; Mchiza, 2013; Vawda, 2011). One of the aims of this study was to address that gap.

This study looked at BMI at each age group (5-12) as BMI is calculated differently for children than for adults, there is also different BMI categories for boys and girls. After BMI was calculated for each age, separately for boys and girls, the data revealed a high percentage of obese children in the 5-year-old age group (boys and girls) 30% and 25% respectively.

Due to the scarcity of data of childhood obesity at younger ages and break down of those ages in South Africa, one cannot conclude to say whether this has increased or decreased. Most often, findings of the younger ages are combined. For instance, the combined obesity rate of ages 5-12 years observed in the NIDS data was 14%, overweight rate was 11%, these finding are consistent with the findings of the National Health and Nutrition Examination Survey of 2012 which found the obesity rate among 6-14-year-old children to be 13.5% (Mchiza, 2013). A similar study in Nigeria found that obesity rates among children were 11.4% and overweight rates were 9.4% in children 5-9 years old (Obong et al., 2012).

By carefully analysing each age group, as this study did, one can see how the bulk of obesity is situated in the younger age groups. This is a cause for concern and draws on the urgent need for not only interventions addressing this rapidly increasing childhood obesity trend, but age specific interventions for childhood obesity as well as the need for preventative measures to be put in place that will serve to protect children who are seen to be at risk of becoming obese. The need for a preventative measure for childhood obesity was also identified in a Western Cape study which focused on children aged 6-13 years (Kristen & Schubl, 2013). The Western Cape study also found significant associations between socioeconomic factors and obesity combined with overweight.

Girls were found to have higher prevalence of obesity as well as over-weight across all the ages, except for age 10. This was also the case in studies that have documented childhood obesity in Sub-Saharan Africa, which showed how girls are more likely to be overweight or obese than young boys (Kirsten, Marais, & Schübl, 2013; Mciza, 2013; Kruger et al., 2005; Mayosi et al., 2009). A biological explanation for this trend is the differences in body composition between males and females, young and old (Kirchengast, 2010). However, with regards to the high rates of obesity and overweightness in children, a behavioral explanation for this is the sedentary lifestyle in which the world tends to live (Kruger, 2005; Mayosi et al., 2009; Obong et al., 2013; Mchiza, 2013; Vawda, 2012; Kristen et al., 2013; Armstrong et al.,

2006). Children are seldom playing outside and being active, rather activities such as watching television and playing video games are have become more prominent than ever before, thus causing inactive lifestyles among children which leads to excessive weight gain.

The NIDS data revealed that the highest obesity and overweight rates are in the African population group with 12% and 10% respectively. Whites and Colored's saw the lowest rates at 1% each and no observations were seen among children in the Indian population group. This finding is also consistent with other study findings, the African population group was found to have the highest obesity rates and overweight rates among children in most studies conducted in South Africa (Armstrong et al., 2006; Kristen et al., 2013).

Most of the studies that are conducted around obesity are done to primarily assess the prevalence of obesity/childhood obesity in a country. Although Viner and Cole (2005) looked at socioeconomic factors in relation to childhood obesity, different socioeconomic factors were addressed, as is the case in other studies (Mchiza, 2013; Viner & Cole, 2005; He et al., 2013; Kristen et al., 2013; Kruger et al., 2005). This study looked at the educational achievement of the parents and found that a significant relationship exists between parental educational achievement and childhood obesity. Childhood obesity rates were highest among mothers with Primary school level of education (7%) and lowest among mothers with Bachelor or Bachelor Plus level of education (1%), this is consistent with the prediction of the theoretical framework (Adler & Ostrove, 1999) which guided this study. Fathers educational achievements were left out due to the fact that majority of South African fathers are absent in their children's lives.

The relationship between occupational status of the mother and childhood obesity and overweight was also examined, and the highest overweight was observed in mothers who work in elementary occupations (4%). Adler and Ostrove (1999) suggest that health is associated to educational achievements, which in turn are linked to occupational status, and as observed in this study, mothers with lower educational achievement are more likely to have obese children than mothers with a higher level of education (Adler & Ostrove, 1999; Cutler & Lleras-Muney, 2006).

The theoretical framework that guided this study was brought to life by the study findings. Income, educational achievements, occupational type, and place of residence are indeed determinants of health. The findings revealed higher childhood obesity rates among children of high and middle-income earning households, and interestingly lower rates of childhood obesity among parents who hold a Bachelor/Bachelor Plus degree. Place of residence was seen

as a key indicator of childhood obesity, with Urban areas housing the highest rate of obese children. Indeed, urbanization does not entail improved quality of life (He et al., 2014).

5.3 Conclusion

In conclusion, the findings of the study reveal the increase in childhood obesity and overweight rates in South Africa, they also reveal the disproportionate distribution of overweightness as over-weight and obesity seems to be quite alarming 5-year-old children. The distribution of childhood obesity follows the social gradient of parental socio-economic factors, as depicted by Adler and Ostrove (1999) framework of socioeconomic status and health. Evidence from other studies and countries is consistent with the findings of this study in that the rate of childhood obesity is indeed on the rise. Unlike most studies, this study looked at BMI for each age group, for male and females, and separated observations for over-weight and obesity instead of combing the two. Childhood obesity is no longer a "disease of the wealthy" (Viner, 2005) but is spreading even into poorer populations

5.3 Recommendations

- Standardized universal measure for childhood obesity needs to be used in studies order to allow for comparisons
- Identification of children who are at risk need to be instilled in schools as a preventative measure for obesity
- Instill culture of an active lifestyle in the younger generation
- Development of interventions to address current levels of childhood obesity
- Integration of Social and Health sector in order to address health disparities
- The development of policies which ensure the body mass index of children is tracked regularly and preventative measures are put in place to prevent childhood obesity

- Monitoring program for already obese/overweight children to work their ways towards middleweight.

- Regular testing for diabetes and hypertension among obese/overweight children as a preventative measure to acquiring these chronic illnesses.

- Ways of getting all population groups to participate more in surveys.

6. Reference List

Albaladejo, R. Villanueva, R. Navalportro, L. Ortega, P. Astasio, P, and Regisor, E (2014). Risk behaviours and sports facilities do not explain socioeconomic differences in childhood obesity: a cross-sectional study. *BMC Public Health.* 1(4), 1-18.

Armstrong, M E G. Lambert, M I. Sharwood, K A and Lambert, E V. (2004) Obesity and overweight in South African primary school children – the health of the national study. *Journal of Endocrinology, Metabolism and Diabetes in South Africa.* 1(9), 52-63

Bammann, K. Gwozdz, L. Barba, G. De Henauw, S. Eiben, G. Fern, J. Kovaca, E. Lissner, L. Moreno, L. Tornaritis, M. Veidebaum, T and, Pigeot, I (2013). Socioeconomic factors and childhood overweight in Europe: results from the multi-centre IDEFICS study *Pediatric Obesity*. 8(1), 1-12.

Berg, G, Eijsden, M, Vrijkotte, T, & Gemke, R (2013). BMI may underestimate the socioeconomic gradient in true obesity, Pediatric Obesity. 3(8), e31-40.

Bor, J. Herbst, A J. Newell, M L and Barnighausen, T. (2013). Increases in Life Expectancy in Rural South Africa: Valuing the Scale-Up of HIV Treatment. *Science.* 6122(339), 961-965.

Bewick, V., Cheek, L. and Ball, J. (2005) Statistics review 14: Logistic regression. Critical Care, 9(1), 1.

Cameron N. Kgamphe JS. Leschner KF. Farrant PJ. (1992) Urban-rural differences in the growth of South African black children. *Ann Hum Biol*. (19), 23-33.

Center for Disease Control and Prevention (2015, May, 15) *Body-mass-index-for-age-percentiles.* Retrieved from https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Cole, T J. Bellizzi, M C. Flegal, K M. Dietz, W H. (2000) 'Establishing a standard definition for child overweight and obesity worldwide: international survey.' *British Medical Journal.* (320), 1240-1243

Currie, C., Zanotti, C., Morgan, A., Currie, D., de Looze, M., Roberts, C., Samdal, O., Smith, O.R. and Barnekow, V., 2009. Social determinants of health and well-being among young people. *Health Behaviour in School-aged Children (HBSC) study: international report from the, 2010*, p.271.

Cutler, D.M. and Lleras-Muney, A., 2006. Education and health: evaluating theories and evidence (No. w12352). National Bureau of Economic Research.

Daniels, S R. (2006) The Consequences of Childhood Overweight and Obesity. *The Future of Children*, 1(16), 47-67.

Dietz, W H. (1998) 'Health Consequences of Obesity in Youth: Childhood Predictors of Adult Disease.' *Journal of the American Academy of Paediatrics,* (101), 518-525.

Dorling, D. (2009) Unemployment and health. *BMJ,* (338), b829-b829.

Duong, J, & Bradshaw, C (2016), HOUSEHOLD INCOME LEVEL AS A MODERATOR OF ASSOCIATIONS BETWEEN CHRONIC HEALTH CONDITIONS AND SERIOUS MENTAL ILLNESS, *Journal Of Community Psychology*, 44(3), 367-383.

Ebeling, C B. Pawlak, D. Ludwig, D S. (2002) Childhood obesity: public-health crisis, common sense cure. *Lancet. (*360), 473-482.

'Facts About Childhood Obesity and Overweightness' 1999, Family Economics & Nutrition Review, 12, 1, p. 52

Gable, S. and Lutz, S. (2000) Household, parent, and child contributions to childhood obesity. *Family relations,* 49(3), 293-300.

Glass, T A. McAtee, M J. (2006) Behavioral science at the cross roads in public health: extending horizons, envisioning the future. *Social Science Medicine.* 62(7), 1650-1671.

Goodman, E. (1999) The role of socioeconomic status gradients in explaining differences in US adolescents' health. *American journal of public health,* 89(10), 522-1528.

He, W. James, S A. Merli, G. Zheng, H. (2014) 'An Increasing Socioeconomic Gap in Childhood Overweight and Obesity in China.' *American Journal of Public Health.* 1(104), 1-10.

Huang, T T. Drewnowski, A. Kumanyika, S K and Glass, T A. (2009) 'A systems Orientated Multilevel Framework for Addressing Obesity in the 21st Century.' *Centeres for Disease Control and Prevention.* 3(6), 1-10.

Ip, P, Ho, F, So, H, Chan, D, Ho, M, Tso, W, & Nelson, E. (2016) Socioeconomic Gradient in Childhood Obesity and Hypertension: A Multilevel Population-Based Study in a Chinese Community, *Plos ONE*, 11(6), 1-12.

Jinabhai, C C. Taylor, M. Sullivan, K R. (2003) Implications of the prevalence of stunting, overweight and obesity amongst South African primary school children: a possible nutritional transition? *European Journal of Nutrition.* (57), 358-365.

KALETA, D, MAKOWIEC-DĄBROWSKA, T, & JEGIER, A (2008) EMPLOYMENT STATUS AND SELF RATED HEALTH, *International Journal Of Occupational Medicine & Environmental Health,* 21(3), 227-236

Kelishadi, R. (2007) Childhood Overweight, Obesity and the Metabolic Syndrome in Developing Countries. *Epidemiologic Reviews.*10 (29), 62-76.

Kirsten, A.P., Marais, D. and Schübl, C. (2013) The influence of socio-demographic factors on the nutritional status of children in the Stellenbosch area, Western Cape. *South African Journal of Clinical Nutrition,* 26(3), 124-131.

Kruger, R. Kruger, H S. MacIntyre, U E. (2005) The determinants of overweight and obesity among 10-15 year old school children in the North-West Province, South Africa – The THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA children) study. *Public Health Nutrition.* 9(3), 351-358.

Low, M, Low, B, Baumler, E, & Huynh, P. (2005) Can Education Policy Be Health Policy? Implications of Research on the Social Determinants of Health, *Journal Of Health Politics, Policy & Law,* 30(6),1131-116.

Mayosi, B M. Flisher, A J. Lalloo, U G. Sitas, F. Tollman, S M. Bradshow, D. (2009) The burden of non-communicable diseases in South Africa. *The Lancet*, 9693(374), 934-947.

Must, A. Strauss, R S. (1999) 'Risks and consequences of child and adolescent obesity. *International Journal of Obesity.* (23), 2-11.

Marmot, M.G., Kogevinas, M. and Elston, M.A., 1991. Socioeconomic status and disease. *WHO Reg Publ Eur Ser*, (37), 113-146.

Martínez-Vizcaíno, V, Solera-Martínez, M, Cavero-Redondo, I, García-Prieto, J, Arias-Palencia, N, Notario-Pacheco, B, Martínez-Andrés, M, Mota, J, Sánchez-López, M, & Cuenca Study, G. (2015) Association between parental socioeconomic status with underweight and obesity in children from two Spanish birth cohorts: a changing relationship, *BMC Public Health,* (15), 1-8

Monteiro, C A. Moura, E C. Conde, W L and Popkin, B M. (2004) Socioeconomic status and obesity in adult populations of developing countries: a review. *Bulletin of the World Health Organization,* 82(12), 940-946.

Neupane, S, Prakash, K, Doku, D, & K C, P. (2016) Overweight and obesity among women: analysis of demographic and health survey data from 32 Sub-Saharan African Countries, *BMC Public Health,* (16), 1-9.

Parkhurst, J O and Lush, L. (2004) The Political Environment of HIV: lessons from a comparison of Uganda and South Africa. *Social Science and Medicine.* (59), 1913-1924

Patel, R B. Burke, T F. (2009) Urbanization – An Emerging Humanitarian Disaster. *The New England Journal of Medicine.* (361), 741-743.

Poskitt, EE. (2014) Childhood obesity in low- and middle-income countries, *Paediatrics & International Child Health,* 34(4), 239-249.

Puoane, T., Tsolekile, L., Sanders, D. and Parker, W., 2008. Chronic non-communicable diseases.

Reilly, J. Armstrong, J. Dorosty, A R. Emmett, P M. Ness, A. Rogers, I. Steer, C and Sherriff, A. (2005) Early life risk factors for obesity in childhood: cohort study. *British Medical Journal,* (10), 1-7.

Ross, C.E. and Wu, C.L., 1995. The links between education and health. American sociological review, pp.719-745.

Sahoo, K, Sahoo, B, Choudhury, A, Sufi, N, Kumar, R, & Bhadoria, A 2015, 'Childhood obesity: causes and consequences', *Journal Of Family Medicine & Primary Care*, 4(2), 187-192.

Strauss, R S. (2007) Childhood Obesity and Self-Esteem *Pediatrics.* (105), 1-5.

Valdés Pizarro, J and Royo-Bordonada, M. (2012) Prevalence of childhood obesity in Spain; National Health Survey 2006-2007 *Nutricion Hospitalaria*, 1(27),154-160.

Viner, R.M. and Cole, T.J. (2005) Adult socioeconomic, educational, social, and psychological outcomes of childhood obesity: a national birth cohort study. *Bmj*, 330(7504), 1354.

Wang, Y. (2001) Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. *International Epidemiological Association.* (30), 1129-1136.

Wu, F., Guo, Y., Chatterji, S., Zheng, Y., Naidoo, N., Jiang, Y., Biritwum, R., Yawson, A., Minicuci, N., Salinas-Rodriguez, A. and Manrique-Espinoza, B., (2015). 'Common risk factors for chronic non-communicable diseases among older adults in China, Ghana, Mexico, India, Russia and South Africa: the study on global AGEing and adult health (SAGE) wave 1.' *BMC public health*, 15(1), 1.